Turkish Style of Innovation

- Power Factor Controllers
- Digital Measuring Instruments
- Overcurrent Protection Relays
- Voltage Monitoring Relays
- Phase Failure Relays
- Electronic Time Relays
- Liquid Level Controllers

KAEL

ISO 9001: 2000

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VARko-112 Reactive Power Factor Controller

1. Foreword

All information and warnings about 1 phase controlled reactive power controller, VARko-1xx*, are given in this User's Manual. Please for your power network's and your own safety, read this manual carefully before commissioning the system. Please contact us for unclear points.

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2. Warnings:

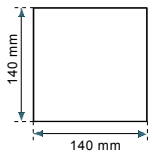
1. The connection, operation and parameter settings of device must be done by authorised technical service staff. Also, system checks must be done by this person when necessary.
2. Since compensation is a complex process, subscribers are advised to keep the system tracking by contracted service staff.
3. Please do not open or do not let others open the device. There are no user serviceable parts inside.
4. Before making the connections to device's terminals, please be sure that there is no voltage across the cables or terminals. Also be sure that the panel is de-energised.
5. Please do not use the device for purposes other then compensation.
6. Please fix the device to electric panel with apparatuses supplied.
7. Please press the buttons only by your fingers, do not press it with any other objects.
8. Before cleaning the device, please be sure that it is de-energised and use only dry tissue-paper to clean it. Water or any other chemicals used for cleaning may harm the device.
9. Before installing the device, please be sure that the terminal connections are made exactly the same as in the connection diagram and avoid any connection problems, such as loose connections or contact of different cables.
10. For each capacitor bank on the compensation system, please prefer contactors with suitable discharge resistors considering the bank power.
11. Please consider total currents drawn by the inductors of contactors while choosing the common contact line, line 'C', fuse value. When contactors with high inductor currents are chosen, for protecting the contact outputs of the device, auxiliary relay must be used.
• **:** The statement VARko-1xx covers both 8 and 12 steps models of the device.

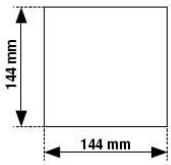
Installation Instructions :

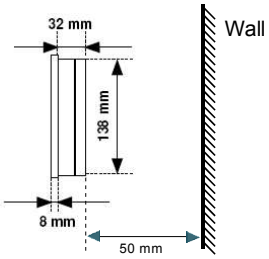
1. A hole with 140 mm x 140 mm must is needed on the panel for device installation
2. Remove the fixing apparatus before installing the device
3. Place the device in the prepared hole from the fromnt side.
4. Use the fixing apparatus to fix the device from the back side to the panel.

CAUTION:
Leave at least 50mm space between the back side of the device and the internal wall of the panel for the airing purpose

Panel Hole Dimensions







3. General Information

Power controller Varko-1xx, which carries compensation accuracy and expectations beyond traditional devices, is developed by KAEL Elektronik to meet very high performance criterions.
The most important properties of VARko-1xx that make it different from traditional type controllers are;
1- Fast commissioning and ease of use,
2- Instead of reaching to target cosfi value, compensating the system as much as close to real axis between the capacitive and inductive bound values. (Bound values can be changed by the user when desired),
3- Automatic C/k calculation,
4- Automatic learning and monitoring of capacitor bank powers (capacitor bank powers can be set by the user when desired. Device also detects any false setting and corrects it by its own as it operates),
5- Dynamically adjusting of normal region boundaries and capacitor switching on&off times with respect to consumed reactive/active percentage,
6- Extending capacitor bank power life by storing switching on&off times separately for each bank,
7- Automatic learning of current transformer polarities even if (k,l) is connected in reverse direction,
8- Calculating current reactive power value and directly switching on or off the most suitable group instead of sequential switching,
9- Making system tracking and fault detection easier with many hand alarms,

3.1 Operating Principles

When the device is energised, it checks first the voltage values. Then, it detects current transformer polarity even if connected in reverse direction. The direction of system's reactive power is calculated through resultant reactive power and resultant power factor. Compensation starts for pulling the system into 'normal region'. Device measures and stores all of active, inductive (+Q) and capacitive (-Q) energies. After mathematical calculations, inductive and capacitive percentage values of the system are calculated continuously and the system is kept under control. Capacitor switching on&off times are calculated separately for each bank. When necessary, the appropriate bank is directly switched if its time is up. Since the Switching Time Values and Normal Region Boundaries are related to consumed energies, they change between the max and min values proportional to percentage energies. During the operation, every capacitor bank's power is calculated when it is switched. Therefore, any change of the capacitor bank's power is detected and stored. Instead of sequential switching of capacitors, the most suitable bank is directly switched. VARko-1xx contains 7 alarms from AL01 to AL09 (2 alarms are reserved for VARko-3xx series) and 1 alarm relay output to warn and inform the user. Alarms are; over voltage, under voltage, over current, over compensation, under compensation, system fault and over temperature. If desired, as much as alarms can disabled by the user. Device also measures the panel temperature and energises the fan relay when temperature exceeds adjusted fan relay limit (adjusted separately from temperature alarm). 4 different operating modes of the device exist. When the device is energised for the first time, it starts from Mod 1. The device can be restricted to Mode1 or Mode 2 if desired. Otherwise it promotes to full automatic mode, Mode 3, after learning/setting all capacitor bank values.

MOD 0 :

This is the manual mode. In this mode, device does not switch the banks by its own. It is accessed by pressing down the set button 3 seconds in Main Menu. In this mode, both mode leds are off, 'EI' text and current display value are continuously interchanged. By pressing down the up button, capacitors are sequentially switched on and by the down button switched off. During the process, the last parameter accessed in the main menu is displayed on the display. By pressing down the set button, system returns to main menu. This mode is used only for testing the system.

MOD 1 :

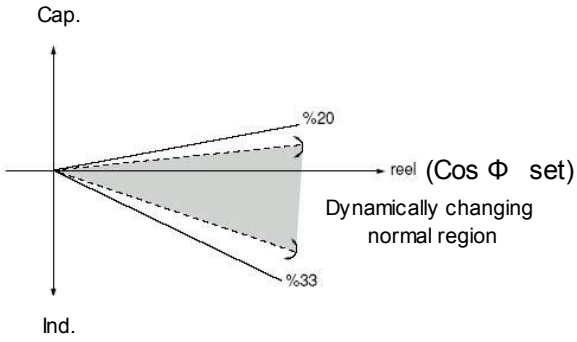
When the device is energised for the first time, it start in Mode 1. Since it knows none of the capacitor bank powers, Normal Region is dynamically calculated through penalty boundaries, consumed inductive and capacitive energies. Capacitor switching is done as 'first-in-first-out'. Device tries to calculate each bank's power after every switching. When the device learns 1st bank's power by its own or it is set by Atrf (Current transformer ratio) and C-01 parameters under Advanced Menu-Cset, it skips Mode 1.

MOD 2 :

If the device learns 1st bank's power by its own or it is set by the user, system operatesin MODE 2. In this mode, additionally to Mode1, since the 1st bank's power is known, C/k is automatically calculated. Except this, it is identical to Mode 1. When the device learns power values of rest of the banks by its own or they are set by Atrf (Current transformer ratio) and C-01, C-02 ... C-12 parameters under Advanced Menu-Cset, it skips Mode 2.

MOD 3 :

If the device has learned all the capacitor banks' powers, it operates in Mode 3. Learning process can be done fully automatically by the device or it can be done by the user by setting Atrf (Current transformer ratio) and C-01, C-02 ... C-12 parameters under Advanced Menu-Cset, just for gaining time. Normal Region is dynamically calculated through penalty boundaries, consumed inductive and capacitive energies. Since in this mode device has all necessary information for compensation, it directly switches the necessary bank instead of sequentially switching with 'first-in-first-out' algorithm. Thus, in this mode, switching logic completely changes in a manner to find appropriate bank to keep the system in normal region and response time to changes in load dramatically decreases. This algorithm gives VARko the ability of keeping system as close as possible to real axis and adapting itself very fast to load characteristics. Once the device has advanced to Mode 3, it will operate in this mode even if it is de-energised and energised again in the future.



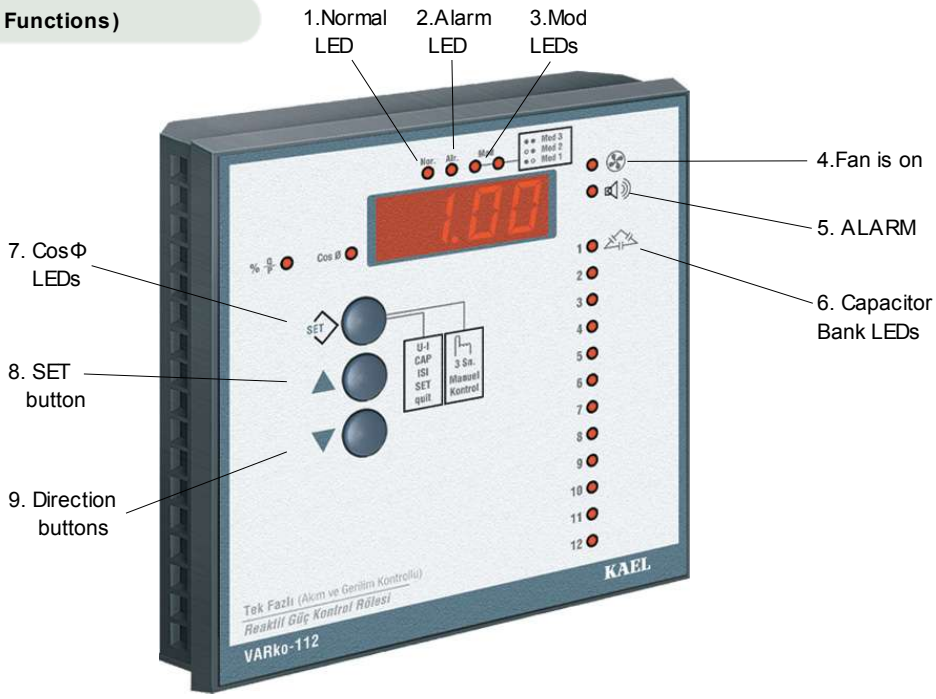
3.2 Measuring Parameters

VARko-1xx gives user the ability of monitoring the following parameters

-cosΦ of Phase R
-Instantaneous percentage value of system (reactive power / active power)
-Current values of phase R
-Voltage values of phase R
-Power of each capacitor bank (in case of correctly setting of current transformer ratio)
-Panel temperature (°C)

VARko-112 Reactive Power Factor Controller

4.FRONT PANEL (Display and LED Functions)



1. Normal LED :Indicates that compensation is in normal region.
2. Alarm LED :If there is any alarm, the LED is on. When the alarm situation disappears, LED is turned off.
3. Mod LEDs : Indicates the operating mode of the device;
Mod 0: Manual operating mode.
Mod 1: Traditional operating mode.
Mod 2: C/k calculation respect to 1st banks power.
Mod 3: Fully automatic operating mode.
4. Fan Is On : When inner panel temperature exceeds set value, fan relay energizes and Fan On LED is turned on.

5. ALARM :In the presence of any alarm, alarm relay is energized for 1 minute, Alarm Output LED and Alarm LED are turned on together. After 1 minute, relay is de-energized, Alarm Output LED is turned on. On the other hand, Alarm LED stays on till the problem disappears.

6.Capacitor Bank LEDs : It shows the switched on capacitor banks.

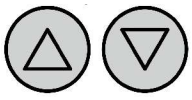
7. CosΦ Leds : Desired values to watch can be accessed in the Main Menu using the direction buttons. In default case, it displays Power Factor of phase system. When the other value is chosen, if non of buttons is pressed for 1 minute, device returns to default state.

$\%\frac{Q}{P}$: instantaneous reactive power/active power percentage of system.

$Cos\Phi_R$:$Cos\Phi_R$, power factor of phase R

8. Set Button : It is used to access to User Menu and Advanced Menu. Also it gives the permission of parameter changes in the menus. Short pressing (less than 1s) brings to User Menu. At power up time, long time press (at least 3s), devices is brought to advanced menu.

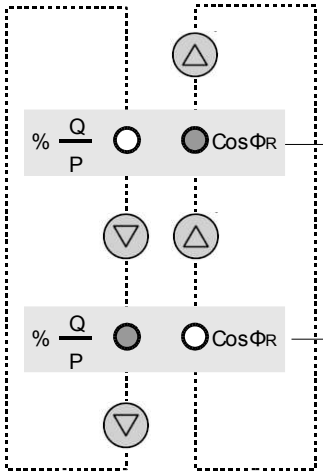
9. Direction Buttons : In the Main Menu, desired parameters can be accessed using these buttons. In other menus, used to browse menus and changing parameter values in setting screen.



5. MENUS and BUTTON FUNCTIONS

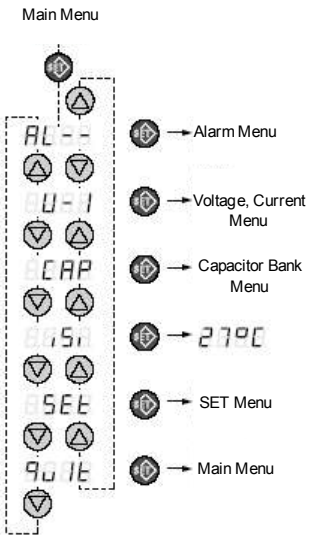
Accessing to menus of VARko-1xx using the buttons is very easy. Using the direction buttons, menus can be browsed in two directions. When you reach the end of the menu, you continue to circular movement. When hold down the directions key, travel speed is increased and you can access to desired location faster. You can enter to desired menu level by pressing down the Set button. Also in the parameter adjustment menus, you can change the values by direction buttons, keep circular movement when you reach to limit values and can store the desired value by pressing down the Set button. In the User Menu, when no button is pressed for 1 minute, device goes back to Main Menu. In Advanced Menu, when no button is pressed for 4 minutes, devices resets itself

5.1 Main Menu



It is the default menu stage that is active during device operation. Every time the device is energized, it starts to operation by showing the power factor. Power factor and instantaneous reactive power/active power % of the system can also be monitored separately using the direction buttons. When any of the parameters is being monitored, if non of the buttons is not pressed for 1 minute, device returns to default state, power factor display. The position of monitored value can be tracked from the Status LEDs. When the displayed value has no sign, this means the value is Inductive and when it is negative, "-", signed, this means value is capacitive.

5.2 User Menu

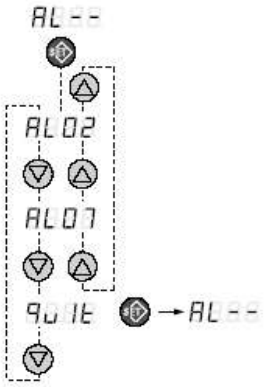


To access the User Menu, press down the Set button for a short time in Main Menu. Direction Buttons are used to move in the menu in desired direction. To enter any submenu, use the Set Button. To change any parameter value while the name and the value is flashing on the screen, press the Set button. Adjust the value using the direction buttons and press again the Set button to store the value. To quit from submenus and User Menu, advance to 'quit' section at the end of the menu and press Set button on it.

In User Menu, alarms (if exists any at that time), voltage and current values of each phase, capacitor bank powers and panel temperature are tracked. Also some set parameters can also be accessed under this menu. The contents of sub-menus and accessing them is described below .

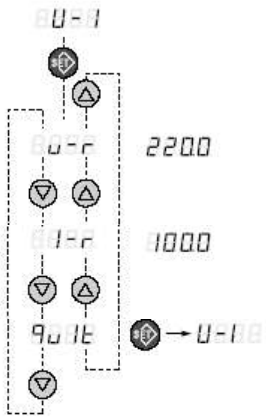
Alarm Menu

►**AL - - :** This menu is displayed only when at least one alarm is present, otherwise it is disabled. The alarm codes of present alarms are monitored under this menu. It is accessed by pressing the Set button. Alarm codes can be monitored using the direction buttons, if are there any other. It can be quited from the menu by pressing the Set button on 'quit' section. **When all alarm conditions are disappeared, device automatically quits this menu**. Alarm codes and detailed information can be found in ALARMS section.



Voltage, Current Menu

►**U-I :** Phase-neutral voltage and current of phase R can monitored here. This section is access by pressing the Set button. Direction buttons are used to advance in desired direction. Phase R voltage and Phase R current are monitored sequentially. When Set button is pressed at the 'quit' section, one level up menu is accessed.
To monitor current values correctly, current transformer ratio must be set in the Advanced Menu.



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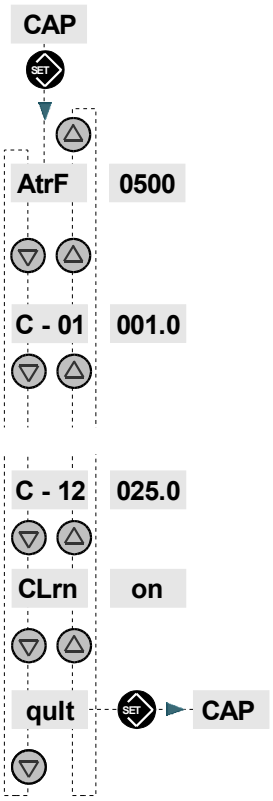


Capacitor Bank Menu

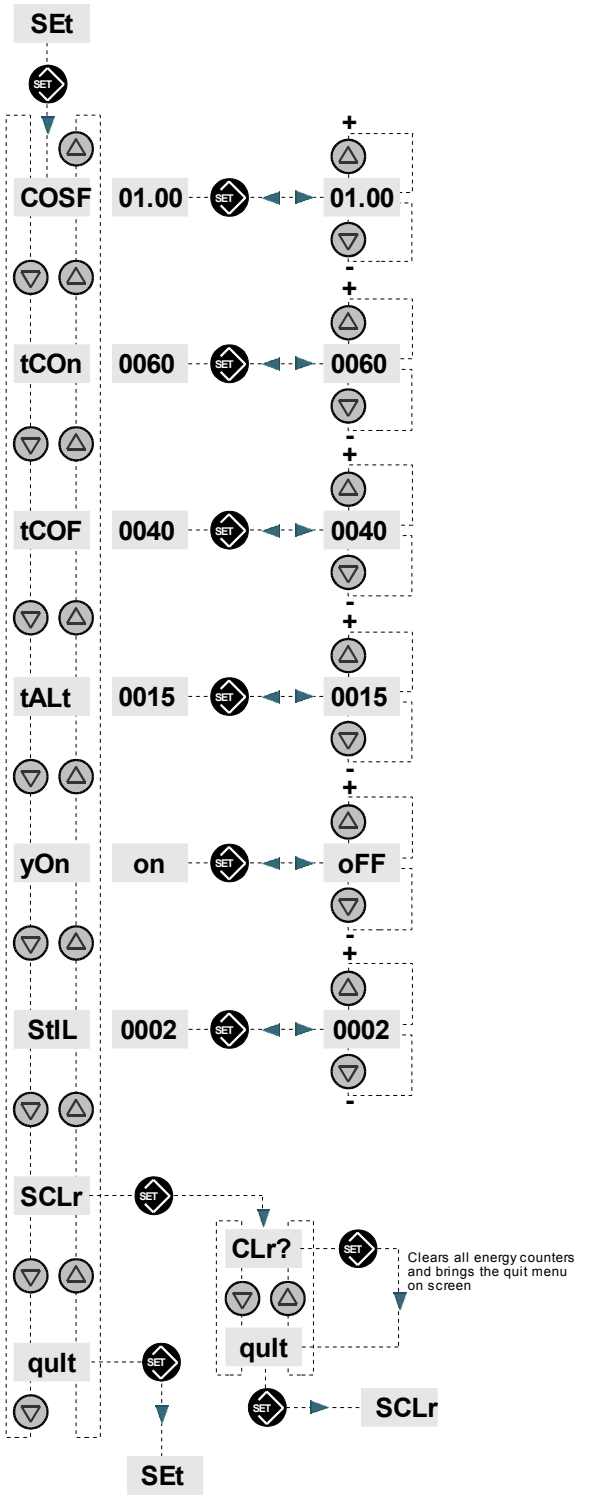
►**CAP :** Current transformer ratio and capacitor bank powers can be displayed separately. This section is accessed pressing the Set button. The current transformer ratio is the first parameter of this menu. Direction button are used to move in the desired direction. From 1st to the last bank power are monitored in this menu in KVAr unit. When Set button is pressed at the 'quit' section, one level up menu is accessed.

This values are changed in Advanced Menu.

CIrn : Capacitor learning mode. If **On** is selected then the capacitor value learning function is on. If **Off** is selected then the device will learn the capacitors values once when the device is installed for the first time and will keep these values without changing.
For some special loads it is suggested to select the Off option.
At the end of this submenu is quit option, pressing SET will take the device to the upper menu.

SCLr: This menu is used to clear active, inductive reactive and capacitive reactive energy counters. For example after getting electricity bills or incase of installing in a new place.
qUIt : Pressing down the set button, the one level up menu section is reached.

►**qUIt :** Pressing down the set button, device returns to main menu.



Temperature Display Menu

►**ISI :** The temperature (°C) inside the device housing is monitored here. Please keep in mind that, the displayed value may be 5-10 (°C) higher than inner panel temperature. Temperature alarm and fan set values can be changed under advanced value.

Set Menu

►**SEt :** The parameters to be set are under this menu. Desired parameter can be accessed by using the direction buttons. On the display, parameter name and numerical value are shown by interchanging. To change the parameter values, press the set button, using the direction buttons reach the desired value. By pressing down the set button, displayed value is stored and the menu is directed to interchange screen. To quit from set menu, advance to 'quit' section and press Set button on it.

COSF:
It is the section that Cosφ value is set in the range of ± 0.80 – 1.00.

tCOn : (Max. capacitor bank switch on time) It can be adjusted in the range of 10-60 secs.

tCOF :(Max. capacitor bank switch off time) It can be adjusted in the range of 10-60 secs. Device calculates the necessary tCOn/tCOff time in the range of tAlt and set value, according to total consumption. Thus, when not necessary, capacitor banks are not switched fast and when necessary faster compensation is achieved automatically.

(Min. value of capacitor bank switch on&off times) It can be adjusted in the range of 2-10 s.

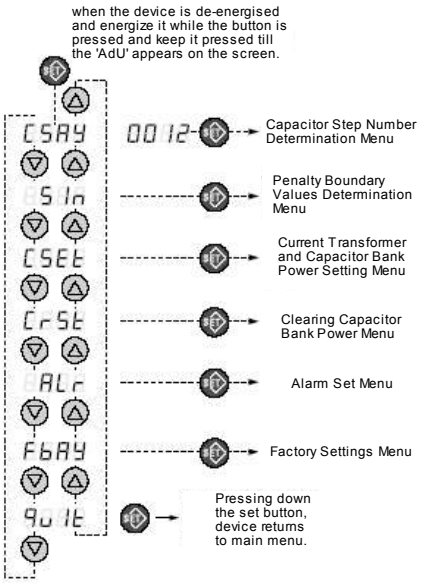
tAlt : (Min. value of capacitor bank switch on&off times) It can be adjusted in the range of 2-10 s.

yOn : The standart value of the direction menu is ***on***. It can be set to ***off*** or ***on***. If it is set to be ***on*** then the learning of the direction of the current transformer will be on all the time. If it is ***off*** then the device will learn the direction once and never try to learn it again. The ***off*** option is suggested for some loads (such as loads that produce export power).

StIL : (Working mode selection) mod01, mod02 and mod03 is used to restrict the operating modes of the device. If mod01 is chosen, device operates only in this mode. If mod02 is chosen, the device operates in mod01 or mod02. If mod03 is chosen, device may choose appropriate mode. Ideally, it is advised to choose mod03.

5.3 ADVANCED MENU

It is the section that important and critical settings of the device can be done. To avoid accidental access to this menu, it is accessed by energizing the device while hold down the set button. It is important to hold down the button when the device is de-energised and energize it while the button is pressed and keep it pressed till the 'AdU' appears on the screen. Using the direction keys, can be advanced in the desired direction. To enter any section, just press set button on it. When set button is pressed on the 'quit' section, device resets itself and starts in normal mode. Also, when no key is pressed for 4 minutes, device resets itself. In both cases, before reset, device stores the changes in its memory.


when the device is de-energised and energize it while the button is pressed and keep it pressed till the 'AdU' appears on the screen.
CSAY
00 12
Capacitor Step Number Determination Menu
S In
Penalty Boundary Values Determination Menu
CSEt
Current Transformer and Capacitor Bank Power Setting Menu
CrSt
Clearing Capacitor Bank Power Menu
ALr
Alarm Set Menu
FbAY
Factory Settings Menu
quIt
Pressing down the set button, device returns to main menu.

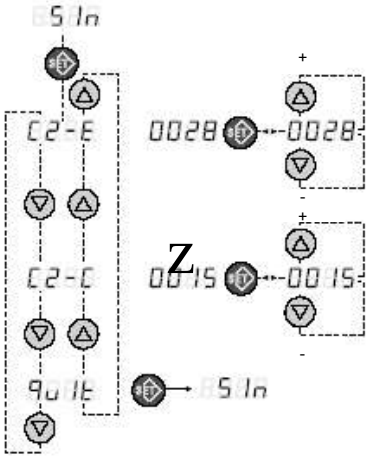
Capacitor Step Number Determination Menu

► **CSAY :**
It is the section that used to set used capacitor step number. Capacitor step number is set in the range of 3-8/12. Parameter name and capacitor step number are shown by interchanging on the screen.

It is advised to set the capacitor step number to the value that you wish to use.

Penalty Boundary Values Determination Menu

► **SIn :**
It is the section that penalty boundary values are adjusted in terms of (reactive energy / active energy) %. It is accessed by pressing the set button. Inductive boundary (CZ-E) and capacitive boundary (CZ-C) are accessed by direction keys. Pressing down the set button, the one level up menu section is reached. Please do not set boundary values to higher values than the limits of your power distributer firm.



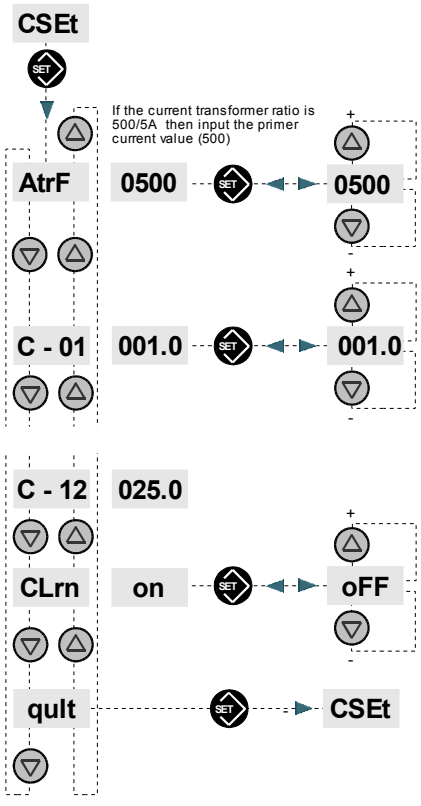
CZ-E : It is the section that inductive penalty value is set as %. It is accessed by pressing the set button, the value is adjusted by using the direction buttons and it is stored by pressing the set button again. It can be set in the range of 10% - 50% (reactive energy / active energy).
If inductive % is close to penalty limit, inductive value can be set to a lower value from here.

CZ-C : It is the section that capacitive penalty value is set as %. It is accessed by pressing the set button, the value is adjusted by using the direction buttons and it is stored by pressing the set button again. It can be set in the range of 5% - 50% (reactive energy / active energy).
If capacitive % is close to penalty limit, capacitive value can be set to a lower value from here.

quit : Pressing down the set button, device returns to main menu.

Current Transformer and Capacitor Bank Power Setting Menu

► **CSEt :** It is the section that current transformer ratio and capacitor bank powers are set. It is accessed by pressing the set button. Using the direction keys, it can be advanced in the desired direction. At quit section, pressing down the set button, the one level up menu section is reached.



AtrF : When current transformer ratio is expressed as x/5, the 'X' value is displayed on the screen and this value is adjusted in the range of 5-10000 by steps of 5. It is accessed by pressing the set button and the value is adjusted using the direction buttons. It is stored by pressing the set button again. Setting this parameter is not necessary for compensation. If you wish to see current values in terms of primer values or want to set capacitor bank powers manually, current transformer value **absolutely** set.
Keeping the direction button pressed down increases advance speed.

C-XX : It is the section that capacitor bank powers are set in KVAr unit. It can be set in the range of 0-current transformer ratio by steps of 0.1 KVAr. It is accessed by pressing the set button and the value is adjusted using the direction buttons. It is stored by pressing the set button again. Before making this adjustment, current transformer ratio **must be** set.
Keeping the direction button pressed down increases advance speed.

Remarks

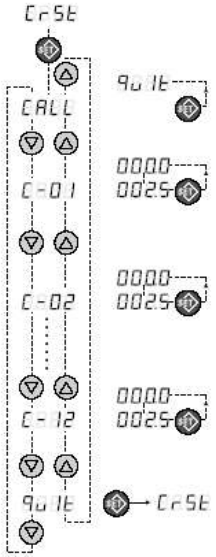
1- Even if capacitor bank powers are not manually set, device learns these values by its own. This may take some time but compensation is continued during learning.

2- In case of setting capacitor bank powers, device directly jumps to mod03 without any time lose.

3- In case of any wrong value setting, device learns the correct value as it operates and overwrites the user set value.

CIrn : Capacitor learning mode.
If **On** is selected then the capacitor value learning function is on
If **Off** is selected then the device will learn the capacitors values once when the device is installed for the first time and will keep these values without changing.
For some special loads it is suggested to select the Off option.

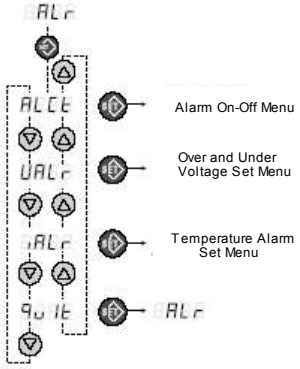
Clearing Capacitor Bank Power Menu



►CrSt :
It is the section that capacitor bank pow ers in device memory are cleared all together or separately.

CALL : It is the section that all capacitor bank pow ers are reset all together. After this operation, all stored bank pow ers are cleared and learned again during bank sw itchings. Operation is approved by pressing the set button. After the process is accomplished, device jumps to quit section at the end of the menu.
Rem: When device is connected to another panel or when most of the bank powers are changed, it is advised to reset all bank powers.
C-XX : Related bank pow er is cleared from device memory. During its operation, this bank pow er is learned again. The operation is approved by pressing the set button. After the process is accomplished, pow er value is displayed as 0. At the quit section, end of the menu, pressing dow n the set button, the one level up menu section is reached.
Rem:When a capacitor bank is changed, it is advised to make reset related bank power. It is not obligated because device keeps learning bank powers during operation.

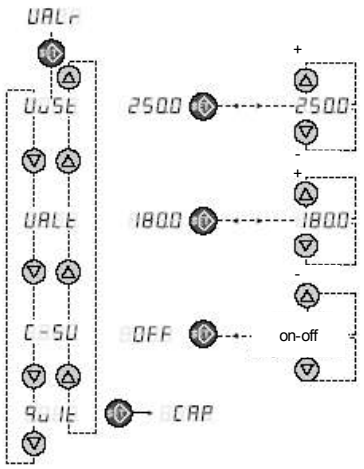
Alarm Set Menu

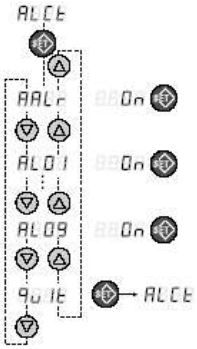


►ALr : It is the section to enable-disable the alarms of device and setting alarm values. It is accessed by pressing the set button. Using the direction buttons can be advanced in desired direction. To quit, advance to 'quit' section at the end of the menu and press Set button to jump one level up.

Over and Under Voltage Set Menu

►UAlr : It is the section that over and under voltage alarm limits are adjusted and Capacitor Save mode is disabled/enabled. It is accessed by pressing the set button and using the direction buttons can be advanced in desired direction. To quit, advance to 'quit' section at the end of the menu and press Set button to jump one level up.
UUSt : It is the section that over voltage alarm limit is adjusted. The value can be set in the range of 230 V – 270 V by steps of 1V. It is accessed by pressing the set button and using the direction buttons can be advanced in desired direction. Press set button to store new value and quit.
Please be sure that this alarm is enabled in ALCt section. Otherwise, these limits are meaningless.
UAlt : It is the section that under voltage alarm limit is adjusted. The value can be set in the range of 170 V – 210 V by steps of 1V. It is accessed by pressing the set button and using the direction buttons can be advanced in desired direction. Press set button to store new value and quit.
Please be sure that this alarm is enabled in ALCt section. Otherwise, these limits are meaningless.
C-SU : It is the place that Capacitor Save mode is disabled/enabled.
If capacitor save is enabled, in case of under/over voltage or missing phase alarms, all capacitor banks are sw itched of sequentially to protect them. It is accessed by pressing the set button, On or Off state is displayed on the screen.
To enable capacitor save, select On and to disable it select Off. Press set button to store the change.





Alarm On-Off Menu

►ALCt : It is the section that all 9 alarms of the device are enabled/disabled all together or seperately. It is accessed by pressing the set button. Using the direction buttons can be advanced in the desired direction. To quit, advance to 'quit' section at the end of the menu and press Set button to jump one level up.
AALr : It is the section that all 9 alarms of the device are enabled/disabled all together. For each alarm, alarm enable state is displayed as On or Off. To enable select On and to disable select Off and to store the change press set button. If you disabled all alarms, separate control menus of alarms w ill disappear automatically.
AL-XX : It is the section that related alarm is disabled/enabled. For more detailed information about alarms, please refer to **Alarms** section. It is accessed by pressing the set button, On or Off state is displayed on the screen. To enable the related alarm, select On and to disable it select Off. Pressing the set button, store the change. *If you cannot see this section, probably all alarms are disable in AAlr section. First enable them all.*

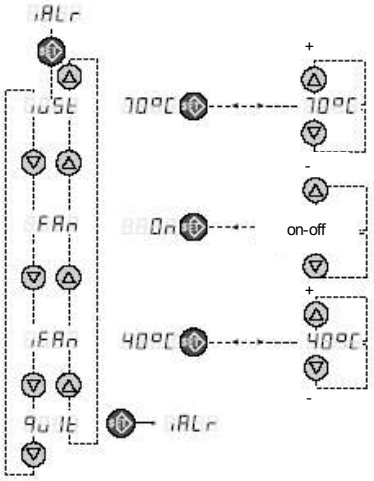
Temperature Alarm Set Menu

►IAlr : It is the section that Temperature Alarm, Fan Temperature and Fan enable/disable state are set. It is accessed by pressing the set button and using the direction buttons can be advanced in desired direction. Press set button at quit section to jump one level up.

IUSt : It is the section that Temperature Alarm value is set. It is adjusted in the range of (Fan temperature limit + 5C) – 80C by steps of 1C. It is accessed by pressing the set button and using the direction buttons can be advanced in desired direction. Press set button to store new value and quit. *Please be sure that this alarm is enabled in ALCt section. Otherwise, these limits are meaningless.*

Fan : It is the section that Fan enable/disable state is set in case of exceeding set fan value. It is accessed by pressing the set button and On / Off state is displayed. To enable fan operation when necessary select On and to disable it select Off by direction buttons. Press set button to store change and quit.

IFan : It is the section that fan operation temperature limit is set. It is adjusted in the range of 25C – (temperature alarm value(iuSt) -5C) by steps of 1C. It is accessed by pressing the set button, the value is adjusted by direction buttons and set by pressing the set button. *Please be sure that fan operation when necessary is enabled in Fan section, otherwise this temperature setting is meaningless.*



Power Meter Type Selection Menu:

►SAYC :

It is the section that power meter type is selected. Either vectorial resultant sum(mechanical meter) mode or arithmetical seperate inductive and capacitive energy storing (electronics meter) mode can be selected. For mechanical meters 'nor' and for electronics meters 'ELEC' is displayed.

Factory Settings Menu

►FbaY : It sets back all user settable parameters to factory defaults. On this section, by pressing the set button, stored values are set back to factory defaults and device turns off itself. To restart the device, please de-energize it and re-energize again.
If you think that device parameters are changed incorrectly and you have difficulty to change them back to original values, you can reset them to factory defaults by using this property.

Factory Defaults are;

-Capacitor bank step number for VARko-112 is 12, for VARko-108 is 8
-Inductive penalty limit value (CZ-E) 20%
-Capacitive penalty limit value (CZ-C) 10%
-Capacitor bank switch-on time max. value 15s
-Capacitor bank switch-off time max. value 10s
-Capacitor bank switch-on&off time min. value 5s
-Over voltage alarm set value (UUSt) 250V
-Under voltage alarm set value (UAlt) 190V
-Capacitor save mode (C-SU) OFF (no protection)
-Fan enable when necessary (Fan) On (Fan output is active)
-Temperature alarm value (IUSt) 70C
-Fan on temperature (Ifan) 45C
-Current transformer ratio 5/5
-Mod03
-All capacitor bank powers are reset to zero

6. ALARMS

To fully control compensation system, to be aware of present problems, to investigate the reasons and overcome these problems, handy and settable alarms are necessary. On the other hand, to be able to disable these alarms when necessary will prevent to panic user. VARko-1xx has the all the alarms necessary for a compensation system and more. Thus, system tracking by technical staff and diagnosis of faults become easier. Below, you will find explanations about the alarms of the device. To obtain more information about alarms, please refer to Alarm Set Menu section under Advanced Menu. When an alarm condition occurs, alarm code can be monitored under User Menu –> ALr section. For further information about this topic, please refer to User Menu section.

When any alarm occurs related to a problem, both alarm LED and relay are energized together. Alarm LED is kept on as long as the alarm condition is continuous, however, alarm relay is de-energized after 1 minutes. Thus, until the technical staff resolves the problem, people around are not disturbed. *When the horn connected to alarm relay is silent, this does not indicated that the problem is disappeared. To understand it alarm LED must be tracked. When alarm situation is continuous please call technical staff. An alarm may have more than one reasons. Therefore, when investigating the reasons of an alarm, you do not have to stop it after finding one reason.*

AL01 : Over Voltage (230V – 270V adjustment range)
If voltage value of any phase exceeds alarm set limit value and this situation continues 5s, alarm LED is turned on and alarm relay is energized. When phase voltages goes 5V below to set limit at least 5s, alarm situation is cleared. If “C-SU” is chosen as On, in over voltage case, banks are switched off sequentially. If it is OFF, compensation is continued. Factory default value is “OFF”.

AL02 : Under Voltage (170V – 210V adjustment range)
If voltage value of any phase goes below alarm set limit value and this situation continues 5s, alarm LED is turned on and alarm relay is energized. When phase voltages goes 5V above to set limit at least 5s, alarm situation is cleared. If "C-SU" is chosen as On, in under voltage case, banks are switched off sequentially. If it is OFF, compensation is continued. Factory default value is "OFF".

AL03 : Over Current(secondary current >8A, constant boundary)
When any of the secondary currents of transformers connected to phases exceed 8A for at least 60s, alarm LED is turned on and alarm relay is energized. If current value goes below 8A at least for 60s, alarm situation is cleared.
Reason: Current transformer is not proper for the system. A higher rate must be preferred.
Solution: Appropriate value must be found by measuring the phase currents and current transformers must be changed with that value.

AL04 : Over Compensation
When system's over all compensation percentage exceeds set capacitive limit, alarm LED is turned on and alarm relay is energized. Until it goes below this limit, alarm condition is continued.
Reason: Capacitor bank powers are chosen to big or improper bank power selection.
Solution: Capacitor bank number must be increased and necessary bank powers must be recalculated & increased. Load must be equally distributed to each phase and the system must be made as balanced as possible. Capacitor switch-off time must be decreased.
AL05 : Under Compensation
When system's over all compensation percentage exceeds set inductive limit, alarm LED is turned on and alarm relay is energized. Until it goes below this limit, alarm condition is continued.
Reason: Capacitor bank powers are chosen to small or improper bank power selection.
Solution: Necessary bank powers must be recalculated and increased. Load must be equally distributed to each phase and the system must be made as balanced as possible. Capacitor switch-off time must be decreased.

AL06 : System Fault
When all capacitor bank powers are measured as 0 KVAr, this alarm is generated.
Reason:
1. Capacitor banks may be connected before the current transformers,
2. Capacitor bank switches may be off
3. Contactor inductance supplies may be off
4. Contact phase (line) may not be connected to device
Solutions:
1. Place capacitor bank connections after current transformers,
2. Check capacitors banks' switches
3. Check contact line connection and contact outputs of devices
4. After all controls, de-energize and re-energize the devices

AL07 and AL08 are reserved for VARko-3xx series.

AL09 : Over Temperature (Fan Limit + 5°C – 80°C range)
When inner panel temperature exceeds set alarm value, alarm LED is on and alarm relay is energized. When temperature goes 2°C below to set value, alarm condition is cleared. Fan relay output of device is different and its set value is adjusted separately. When setting temperature value, please keep in mind that, device temperature is 5-10°C higher than panel temperature.

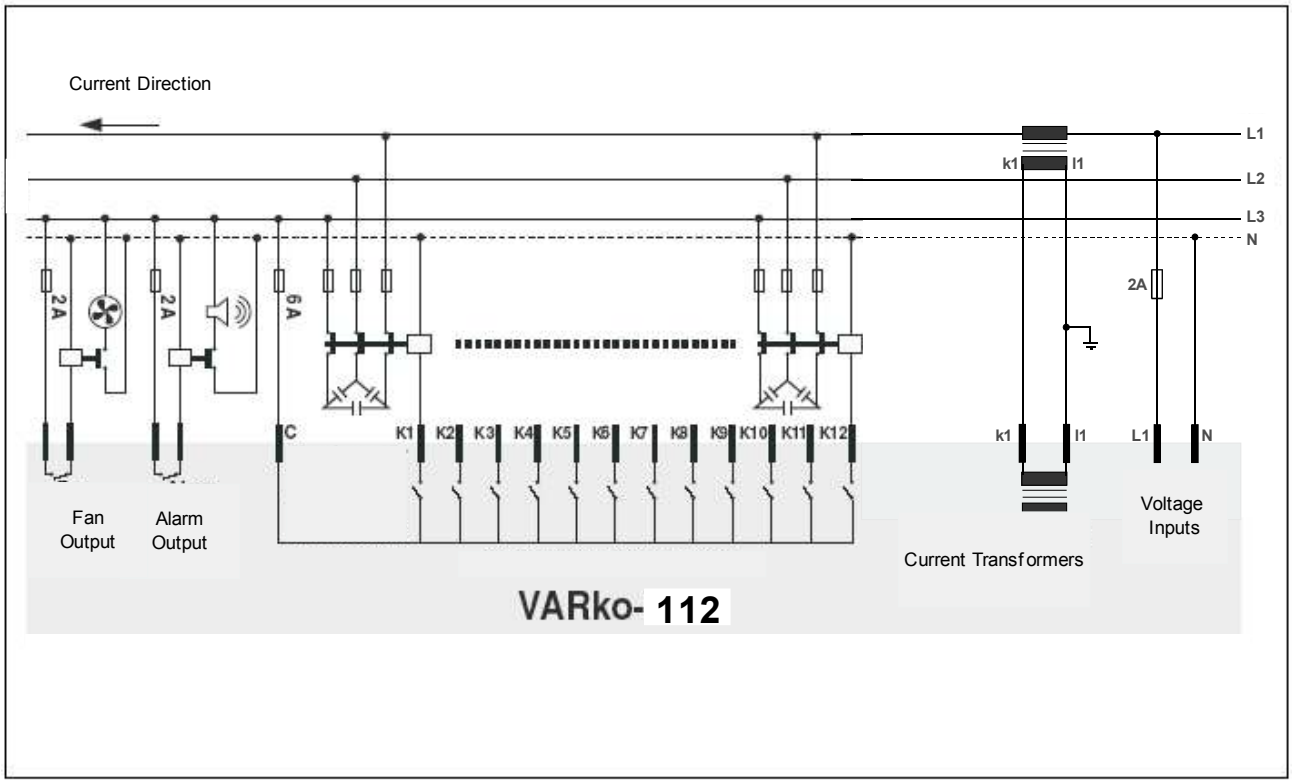
Fan Relay Output: (25°C – Fan limit-5°C)
VARko-1xx gives the user opportunity of tracking and controlling the temperature. When temperature exceeds set fan value, fan relay is energized. If you connect this output to a fan, the panel may be cooled before its temperature reaches to critical limit. If the temperature continues to increase, over temperature alarm is generated and user is warned. The device will let you to adjust Fan temperature value at least 5°C less than temperature alarm value. For example, if over temperature alarm value is 55°C, fan value may be max. 50°C.

VARko-112 Reactive Power Factor Controller

7. COMMISSIONING THE SYSTEM

- Please read warnings and cautions in section 2 of this user's manual
- Please be sure that the electric panel being used is de-energized
- Please be sure that compensation panel is supply voltages are taken after the current transformers in main panel
- Please be sure that current, voltage and contact outputs are connected exactly as shown in the connection diagram
- Switch on the switches of capacitor banks
- Energize the compensation system. If you see Err1 or Err2 message on the screen, immediately contact with KAEL Elektronik Ltd. Please.
- VARko-1xx will immediately start to compensation depending on the consumed power. If there is no current is drawn from the system, device will wait until any current is drawn. In this case, you may consider it as a good test opportunity and test your system in mod00 (manual mode) by switching all capacitor banks on and off.
- If you choose current transformer ratio and capacitor bank power appropriately, in most of the cases you do not need to change any setting of the device.
- Please be sure that alarm LED is off. Otherwise, investigate the reason of alarm and solve the problem.

8. Connection Diagram

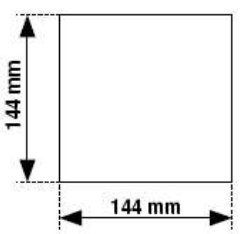


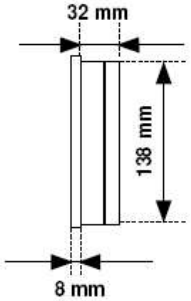
The fuses shown in the connection diagram must be FF type and must have specified current values.
Chosen current transformers' real value must not be less than drawn current and they must be X/5 Amps.
It must be stated on the switches that are connected to supply voltage lines of the device that they will be used to disconnect the device from the power line.
Before making the connections, the warnings and cautions in section 2 must be read.

10. TECHNICAL DATA

Rated Voltage(Un)	: (Phase-Neutral) 220VAC,
Operating Range	: (0.8 – 1.1) x Un
Operating Frequency	: 50 Hz
Power Consumption	: < 10 VA
Measurement Inputs	
Power Consumption	: < 1 VA
Contact Current	: Max. 3 A /240 VAC
Current Measurement Range	: (As secondary current of Curr. Trf.) 0.1-6 Amp AC
Display Range	:(Power Factor) 0.00 – 1.00 Ind.&Cap.
Min. Current Measurement Value	: 50 mA
Measurement Sensitivity	: 1%+- digit
Current Transformer Ratio	: 5/5 .... 10000/5 A
Max. Cap. Bank Switch On&Off Time	: 10.... 60 s
Min. Cap. Bank Switch On&Off Time	: 2.... 10s
Ind% Set Value	: 10%... 50% (Factory set value=20%)
Cap% Set Value	: 5%... 50% (Factory set value=10%)
Display	: 4 Digits LED Display

Protection Class	: IP 20
Connector Protection Class	: IP 00
Ambient Temperature	: -5°C....+50°C
Humidity	:15%....95%
Connection Type	: To front panel tap
Dimensions	: 144x144x40 mm





MULTISER-01-96 Network Analyser

SPECIFICATIONS

- Microprocessor based
- Measurement of 3 phase electrical quantities (VL-N, A, CosΦ, VL-L, Hz, W, VAr, VA ΣW, ΣVAr, ΣVA, ΣWh, ΣVArh, ΣVAh)
- 1-60 min. adjustable demand values (VL-N, A, CosΦ, VL-L, W, VAr, VA)
- Correct learning of current transformer polarity (even if (k,l) is connecte in reverse direction)
- Setting of current and voltage transformer ratios
- Seperate or all together clearance of stored demand, peak and energy values
- Easy access to menus
- Reduces both number of measurement equipment used in the panel and connection time
- Lowers electrical panel costs

Foreword

All information and warnings about Network Analyser MULTISER are given in this User's Manual. Please for your power network's and your own safety, read this manual carefully before commissioning the system. Please contact us for unclear points.
KAEL Müh. Elektronik Tic ve San. Ltd Şti.
1201/1 sok. No:14R Yenisehir -IZMIR – TÜRKİYE
Tel: +90-232-4586085, email: info@kael.com.tr, web: www.kael.com.tr .

Warnings:

1- The connection, operation and parameter settings of device must be done by authorised technical service staff. Also, system checks must be done by this person when necessary.
2- Please do not open or do not let others open the device. There are no user serviceable parts inside.
3- Before making the connections to device's terminals, please be sure that there is no voltage across the cables or terminals. Also be sure that the panel is de-energised.
4- Please fix the device to electric panel with apparatuses supplied.
5- Please press the buttons only by your fingers, do not contact anyother object with them.
6- Before cleaning the device, please be sure that it is de-energised and use only dry tissue-paper to clean it. Water or any other chemicals used for cleaning may harm the device.
7- Before commissioning the device, please be sure that the terminal connections are made exactly the same as in the connection diagram and avoid any connection problems, such as loose connections or contact of different cables.

General

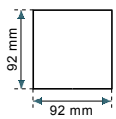
Multiser gives the ability of tracking electrical parameters for 3 phase systems such as, phase currents, phase-neutral & phase-phase voltages, frequency, power factor, active powers, reactive powers and apparent powers. It also stores consumed energies. It also gives the opportunity of tracking total, max. demand and peak values for stated quantities.Current and voltage transformer ratios can be set by the user.
Using the directions buttons, desired parameters can be accessed easily. On the other hand, its displays make it possible to track values from long distance.

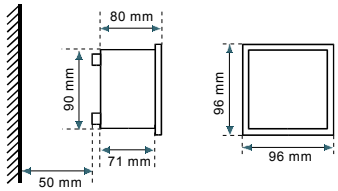
Installation Instructions :

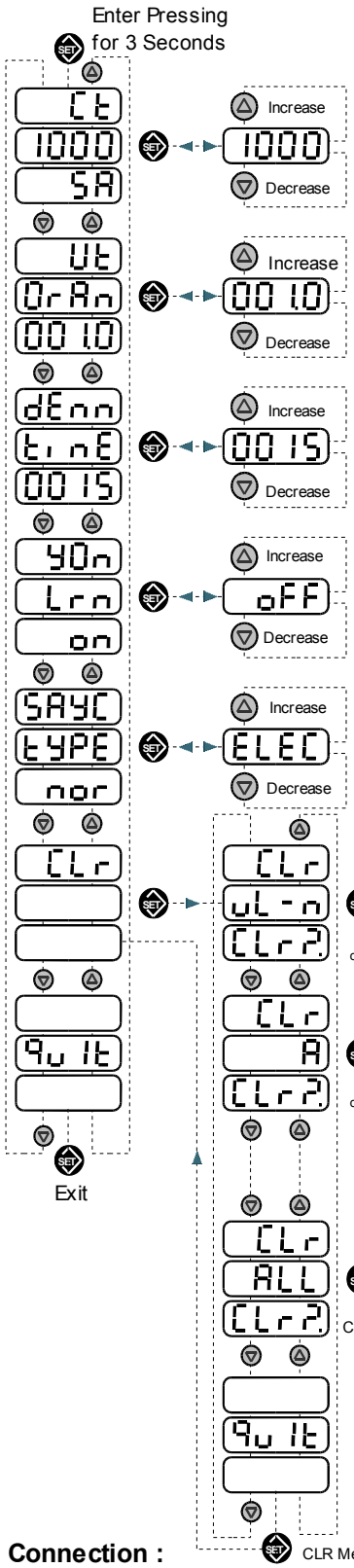
1. A hole with 92mm x 92 mm must is needed on the panel for device installation
2. Remove the fixing apparatus before installing the device
3. Place the device in the prepared hole from the fromnt side.
4. Use the fixing apparatus to fix the device from the back side to the pannel.

CAUTION:
Leave at least 50mm space between the back side of the device and the internal wall of the pannel for the airing purpose

Panel Hole Dimensions



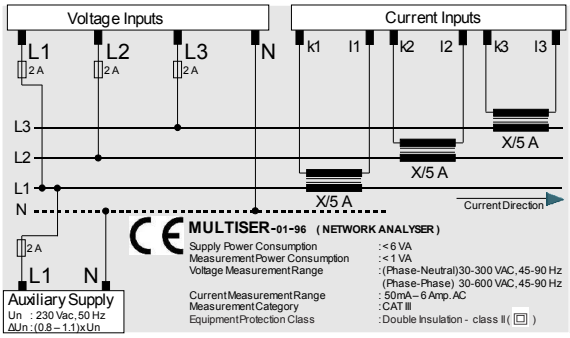




ACCESSING PARAMETERS:
Using the direction buttons, it is possible to move up and down in the menu. When set button is pressed down for 3 seconds, parameter setting menu is accessed and To set any of the parameters, first set button is pressed, then using the directions buttons, value is increased/decreased. When desired value is reached, it is stored by pressing the set button. Using the direction buttons.
Ct: Current transformer value : (5...10000) The current tranformer's primary value should be entered. For example if 500/5A current isused then 500 must be entered.
Ut: Voltage transformer value : (1...1000) If no voltage transformer is used, this parameter must be left as 1.
denn tinE : Demand time : (5-60 min) Demand time parameter, determines the calculation period of demand and peak values.
YOn Lrn: Current transformer polarity direction learning: (on – oFF) If it is " on " then the device would learn the directin automatically. If the device monted in new panel or the polarity somehow changed then it learns the new direction. If off then the device would learn the direction once and never learn it again. Off position is required for some loads. If there would be a problem in the surrent transformer direction then the current transformer inputs shuld be switched.
SAYC tYPE : Counter type : (nor-ELEC) nor: Energies are calculated due the vectorial sun of the phases.
ELEC: Energies are calculated for each phase separately.
CLr: To clear demand, peak and enegy values:
placed where the stored values like demand, peak values and energies are cleared. Values can be cleared either separately or all together, from ALL section, under this menu. In order to clear the stored values SET buttonmust be pressed. The following parameters can be set:
CLr uL-n :Clears the demand and the peak values of the phase-neutral voltages
CLr A :Clears the demand and the peak values of the currents
CLr uL-L :Clears the demand and the peak values of the phase-phase voltages
CLr P :Clears the demand and the peak values of the active energies
CLr q :Clears the demand and the peak values of the reactive energies
CLr S :Clears the demand and the peak values of the apparent energies
CLr hr-- :Clears the stored active, reactive and apparent energy sums
CLr ALL : Clears all mentioned values above

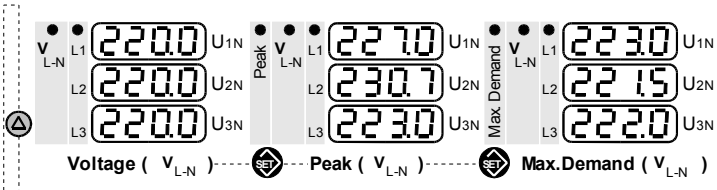
Note: If no button is pressed for 4 minutes under this menu, device automatically quits programming menu.

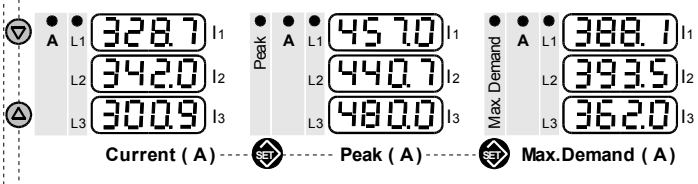
Connection :

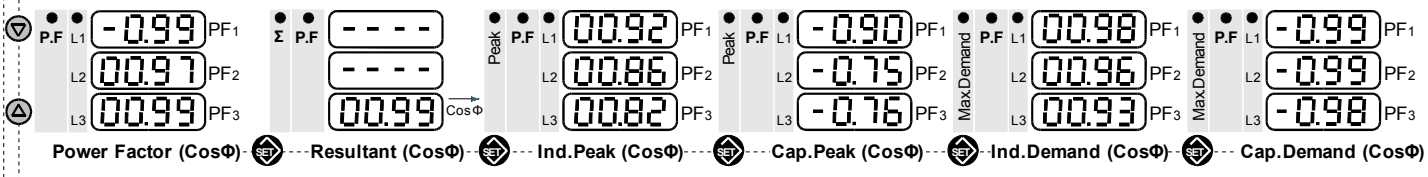


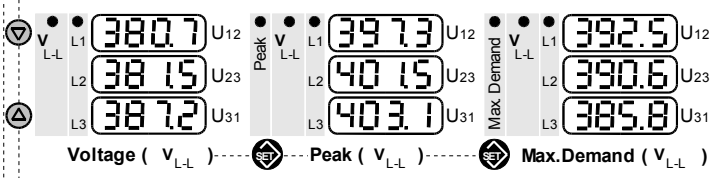
Measured Electrical Parameters

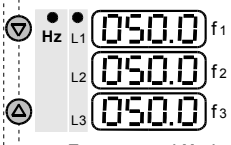
(VL-N, A, CosΦ, VL-L, Hz, W, VAr, VA, ΣW, ΣVAr, ΣVA, ΣWh, ΣVArh, ΣVAh)
These parameters can be reached using the direction buttons, with the related led on and with the measured values for the three phases shown simultaneously.

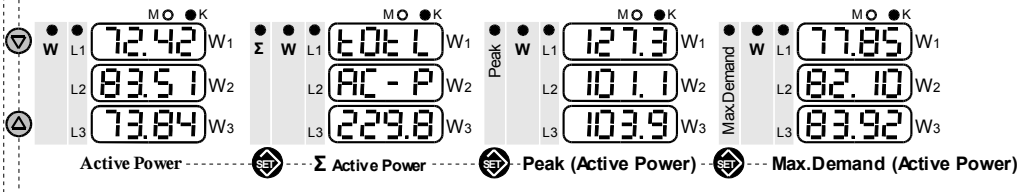

V L-N L1 220.0 U1N
L2 220.0 U2N
L3 220.0 U3N
Peak V L-N L1 227.0 U1N
L2 230.7 U2N
L3 223.0 U3N
Max Demand V L-N L1 223.0 U1N
L2 221.5 U2N
L3 222.0 U3N
Voltage (VL-N) SET Peak (VL-N) SET Max.Demand (VL-N)

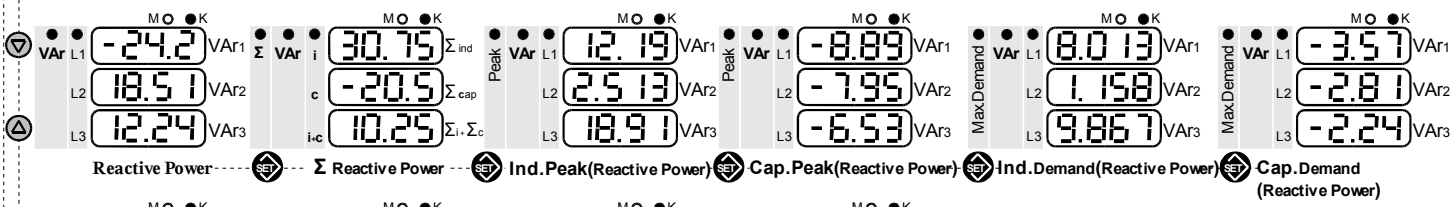

A L1 328.7 I1
L2 342.0 I2
L3 300.9 I3
Peak A L1 457.0 I1
L2 440.7 I2
L3 480.0 I3
Max Demand A L1 388.1 I1
L2 393.5 I2
L3 362.0 I3
Current (A) SET Peak (A) SET Max.Demand (A)

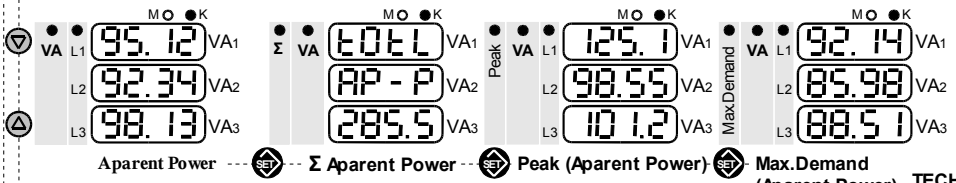

P.F L1 -0.99 PF1
L2 00.97 PF2
L3 00.99 PF3
Σ P.F ---- ---- 00.99 CosΦ
Peak P.F L1 00.92 PF1
L2 00.86 PF2
L3 00.82 PF3
Peak P.F L1 -0.90 PF1
L2 -0.75 PF2
L3 -0.76 PF3
MaxDemand P.F L1 00.98 PF1
L2 00.96 PF2
L3 00.93 PF3
MaxDemand P.F L1 -0.99 PF1
L2 -0.99 PF2
L3 -0.98 PF3
Power Factor (CosΦ) SET Resultant (CosΦ) SET Ind.Peak (CosΦ) SET Cap.Peak (CosΦ) SET Ind.Demand (CosΦ) SET Cap.Demand (CosΦ)

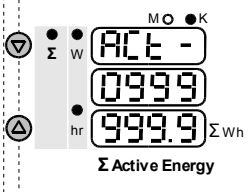

V L-L L1 380.7 U12
L2 381.5 U23
L3 387.2 U31
Peak V L-L L1 397.3 U12
L2 401.5 U23
L3 403.1 U31
Max Demand V L-L L1 392.5 U12
L2 390.6 U23
L3 385.8 U31
Voltage (VL-L) SET Peak (VL-L) SET Max.Demand (VL-L)

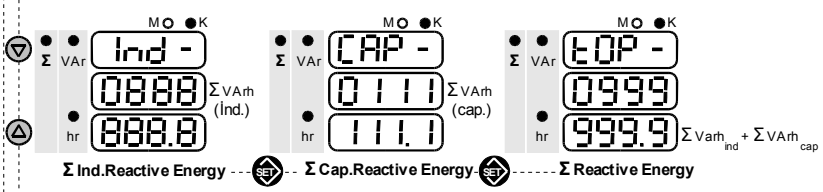


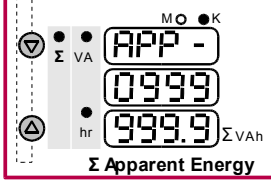

W L1 72.42 W1
L2 83.51 W2
L3 73.84 W3
Σ W L1 TOTL W1
L2 AC-P W2
L3 229.8 W3
Peak W L1 127.3 W1
L2 101.1 W2
L3 103.9 W3
MaxDemand W L1 77.85 W1
L2 82.10 W2
L3 83.92 W3
Active Power SET Σ Active Power SET Peak (Active Power) SET Max.Demand (Active Power)


VAr L1 -24.2 VAr1
L2 18.51 VAr2
L3 12.24 VAr3
Σ VAr i 30.75 Σind
c -20.5 Σcap
i+c 10.25 Σi+Σc
Peak VAr L1 12.19 VAr1
L2 2.513 VAr2
L3 18.91 VAr3
Peak VAr L1 -8.89 VAr1
L2 -7.95 VAr2
L3 -6.53 VAr3
MaxDemand VAr L1 8.013 VAr1
L2 1.158 VAr2
L3 9.867 VAr3
MaxDemand VAr L1 -3.57 VAr1
L2 -2.81 VAr2
L3 -2.24 VAr3
Reactive Power SET Σ Reactive Power SET Ind.Peak(Reactive Power) SET Cap.Peak(Reactive Power) SET Ind.Demand(Reactive Power) SET Cap.Demand (Reactive Power)


VA L1 95.12 VA1
L2 92.34 VA2
L3 98.13 VA3
Σ VA TOTL VA1
AP-P VA2
285.5 VA3
Peak VA L1 125.1 VA1
L2 98.55 VA2
L3 101.2 VA3
MaxDemand VA L1 92.14 VA1
L2 85.98 VA2
L3 88.51 VA3
Aparent Power SET Σ Aparent Power SET Peak (Aparent Power) SET Max.Demand (Aparent Power)







TECHNICAL DATA:

Rated Voltage (Un)	: 230 VAC
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 Hz
Supply Power Consumption	: < 6 VA
Measurement Power Consumption	: < 1 VA
Voltage Measurement Range	: (Phase-Neutral)30-300 VAC, 45-90 Hz (Phase-Phase) 30-600 VAC, 45-90 Hz
Current Measurement Range	: (Secondary current) 50mA – 6 Amp. AC
Display Range	: 0 – 999.9 kV 0 – 999.9 M (W, VAr, VA) (Cosφ) 0.00 – 1.00 ind. & cap.
Minimum Measurement Values	: 50 mA, 30V
Measurement Sensitivity	: 1% ± digit
Voltage Transformer Ratio	: 1 1000
Current Transformer Ratio	: 5/5 ..... 10000/5 A
Display	: 4 Digits LED display
Measurement Category	: CAT III
Equipment Protection Class	: Double Insulation - class II ( )
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 96x96x80 mm

MULTISER-01-96 Network Analyser

SPECIFICATIONS

- Microprocessor based
- Measurement of 3 phase electrical quantities (VL-N, A, CosΦ, VL-L, Hz, W, VAr, VA ΣW, ΣVAr, ΣVA, ΣWh, ΣVArh, ΣVAh)
- 1-60 min. adjustable demand values (VL-N, A, CosΦ, VL-L, W, VAr, VA)
- Correct learning of current transformer polarity (even if (k,l) is connecte in reverse direction)
- Setting of current and voltage transformer ratios
- Seperate or all together clearance of stored demand, peak and energy values
- Easy access to menus
- Reduces both number of measurement equipment used in the panel and connection time
- Lowers electrical panel costs

Foreword

All information and warnings about Network Analyser MULTISER are given in this User's Manual. Please for your power network's and your own safety, read this manual carefully before commissioning the system. Please contact us for unclear points.
KAEL Müh. Elektronik Tic ve San. Ltd Şti.
1201/1 sok. No:14R Yenisehir -IZMIR – TÜRKİYE
Tel: +90-232-4586085, email: info@kael.com.tr, web: www.kael.com.tr .

Warnings:

1- The connection, operation and parameter settings of device must be done by authorised technical service staff. Also, system checks must be done by this person when necessary.
2- Please do not open or do not let others open the device. There are no user serviceable parts inside.
3- Before making the connections to device's terminals, please be sure that there is no voltage across the cables or terminals. Also be sure that the panel is de-energised.
4- Please fix the device to electric panel with apparatuses supplied.
5- Please press the buttons only by your fingers, do not contact anyother object with them.
6- Before cleaning the device, please be sure that it is de-energised and use only dry tissue-paper to clean it. Water or any other chemicals used for cleaning may harm the device.
7- Before commissioning the device, please be sure that the terminal connections are made exactly the same as in the connection diagram and avoid any connection problems, such as loose connections or contact of different cables.

General

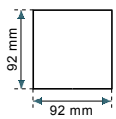
Multiser gives the ability of tracking electrical parameters for 3 phase systems such as, phase currents, phase-neutral & phase-phase voltages, frequency, power factor, active powers, reactive powers and apparent powers. It also stores consumed energies. It also gives the opportunity of tracking total, max. demand and peak values for stated quantities.Current and voltage transformer ratios can be set by the user.
Using the directions buttons, desired parameters can be accessed easily. On the other hand, its displays make it possible to track values from long distance.

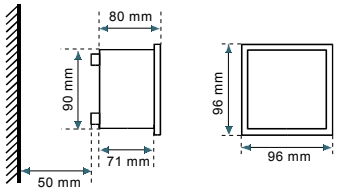
Installation Instructions :

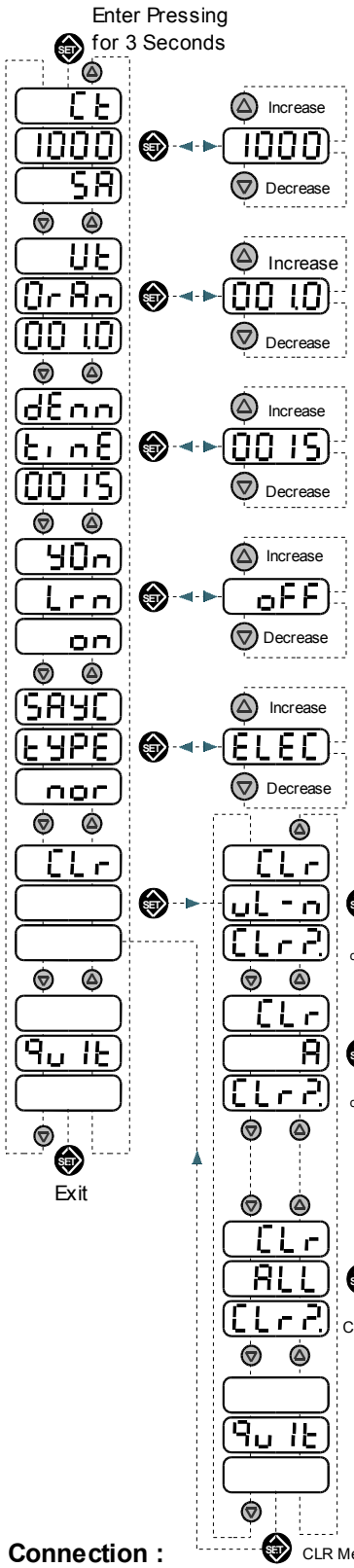
1. A hole with 92mm x 92 mm must is needed on the panel for device installation
2. Remove the fixing apparatus before installing the device
3. Place the device in the prepared hole from the fromnt side.
4. Use the fixing apparatus to fix the device from the back side to the pannel.

CAUTION:
Leave at least 50mm space between the back side of the device and the internal wall of the pannel for the airing purpose

Panel Hole Dimensions



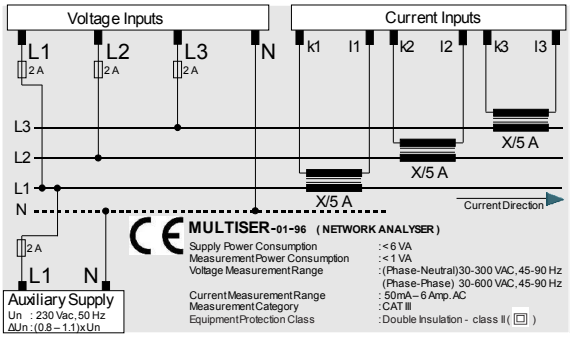




ACCESSING PARAMETERS:
Using the direction buttons, it is possible to move up and down in the menu. When set button is pressed down for 3 seconds, parameter setting menu is accessed and To set any of the parameters, first set button is pressed, then using the directions buttons, value is increased/decreased. When desired value is reached, it is stored by pressing the set button. Using the direction buttons.
Ct: Current transformer value : (5...10000) The current tranformer's primary value should be entered. For example if 500/5A current isused then 500 must be entered.
Ut: Voltage transformer value : (1...1000) If no voltage transformer is used, this parameter must be left as 1.
denn tinE : Demand time : (5-60 min) Demand time parameter, determines the calculation period of demand and peak values.
YOn Lrn: Current transformer polarity direction learning: (on – oFF) If it is " on " then the device would learn the direction automatically. If the device monted in new panel or the polarity somehow changed then it learns the new direction. If off then the device would learn the direction once and never learn it again. Off position is required for some loads. If there would be a problem in the surrent transformer direction then the current transformer inputs shuld be switched.
SAYC tYPE : Counter type : (nor-ELEC) nor: Energies are calculated due the vectorial sum of the phases.
ELEC: Energies are calculated for each phase separately.
CLr: To clear demand, peak and enegy values:
placed where the stored values like demand, peak values and energies are cleared. Values can be cleared either separately or all together, from ALL section, under this menu. In order to clear the stored values SET buttonmust be pressed. The following parameters can be set:
CLr uL-n :Clears the demand and the peak values of the phase-neutral voltages
CLr A :Clears the demand and the peak values of the currents
CLr uL-L :Clears the demand and the peak values of the phase-phase voltages
CLr P :Clears the demand and the peak values of the active energies
CLr q :Clears the demand and the peak values of the reactive energies
CLr S :Clears the demand and the peak values of the apparent energies
CLr hr-- :Clears the stored active, reactive and apparent energy sums
CLr ALL : Clears all mentioned values above

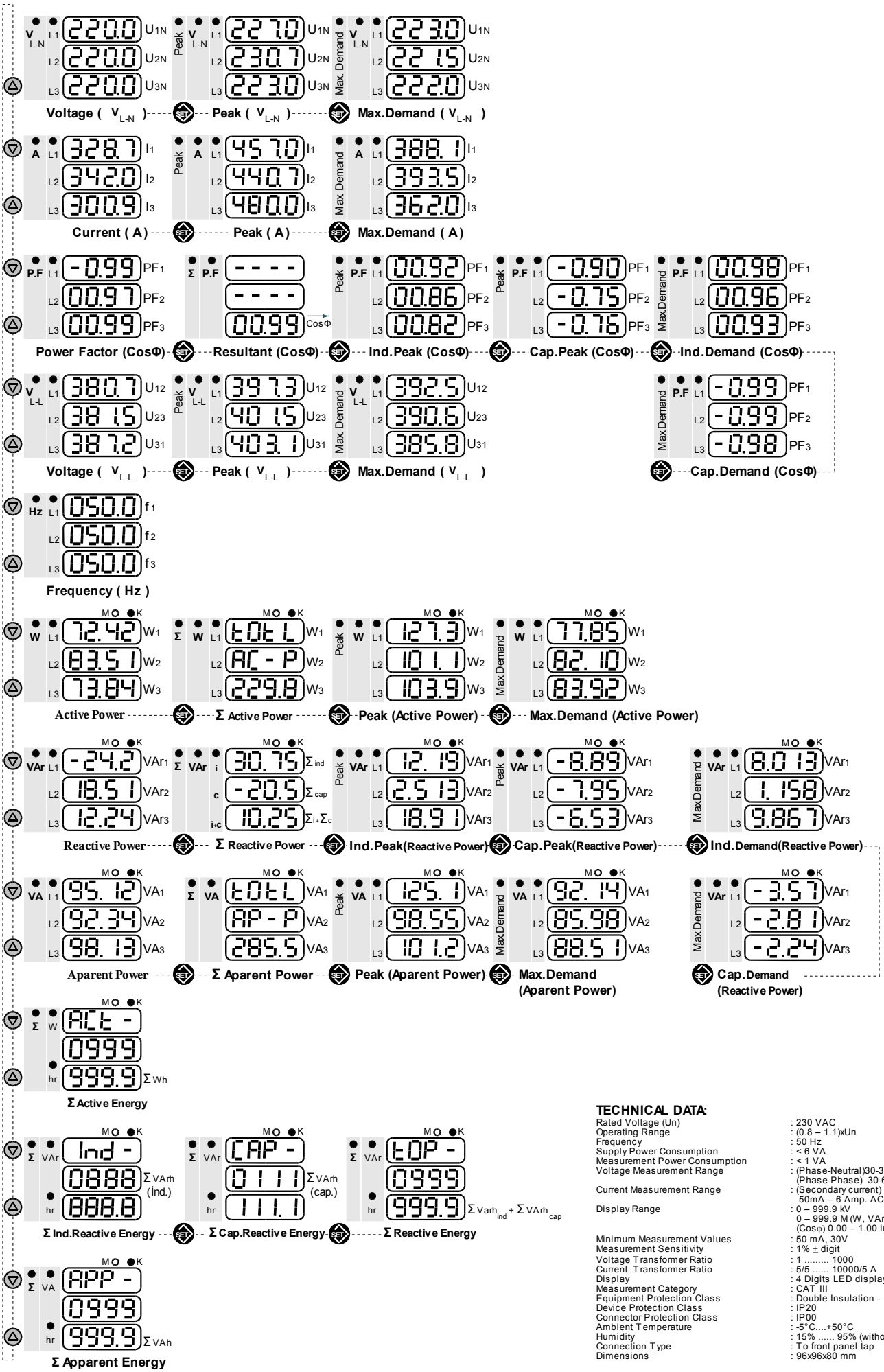
Note: If no button is pressed for 4 minutes under this menu, device automatically quits programming menu.

Connection :



Measured Electrical Parameters

(VL-N, A, CosΦ, VL-L, Hz, W, VAr, VA, ΣW, ΣVAr, ΣVA, ΣWh, ΣVArh, ΣVAh)
These parameters can be reached using the direction buttons, with the related led on and with the measured values for the three phases shown simultaneously.


Voltage (V L-N) SET Peak (V L-N) SET Max.Demand (V L-N)
Current (A) SET Peak (A) SET Max.Demand (A)
Power Factor (CosΦ) SET Resultant (CosΦ) SET Ind.Peak (CosΦ) Cap.Peak (CosΦ) Ind.Demand (CosΦ)
Voltage (V L-L) SET Peak (V L-L) SET Max.Demand (V L-L)
Cap.Demand (CosΦ)
Frequency (Hz)
Active Power SET Σ Active Power SET Peak (Active Power) Max.Demand (Active Power)
Reactive Power SET Σ Reactive Power Ind.Peak(Reactive Power) Cap.Peak(Reactive Power) Ind.Demand(Reactive Power)
Aparent Power SET Σ Aparent Power SET Peak (Aparent Power) Max.Demand (Aparent Power)
Cap.Demand (Reactive Power)
Σ Active Energy
Σ Ind.Reactive Energy SET Σ Cap.Reactive Energy SET Σ Reactive Energy
Σ Apparent Energy

TECHNICAL DATA:

Rated Voltage (Un)	: 230 VAC
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 Hz
Supply Power Consumption	: < 6 VA
Measurement Power Consumption	: < 1 VA
Voltage Measurement Range	: (Phase-Neutral)30-300 VAC, 45-90 Hz (Phase-Phase) 30-600 VAC, 45-90 Hz
Current Measurement Range	: (Secondary current) 50mA – 6 Amp. AC
Display Range	: 0 – 999.9 kV 0 – 999.9 M (W, VAr, VA) (Cosφ) 0.00 – 1.00 ind. & cap.
Minimum Measurement Values	: 50 mA, 30V
Measurement Sensitivity	: 1% ± digit
Voltage Transformer Ratio	: 1 1000
Current Transformer Ratio	: 5/5 ..... 10000/5 A
Display	: 4 Digits LED display
Measurement Category	: CAT III
Equipment Protection Class	: Double Insulation - class II ( )
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 96x96x80 mm

REGISTER TABLE

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NO	ADRES (HEX)	(R)read (W)write	PARAMETER		FORMAT	MULTIPLIER	UNIT	INSTRUCTION	
1	0000	R	COUNTRY CODE (TURKEY)		unsigned int	1		869	
2	0001	R	COMPANY CODE		unsigned int	1		7436	
3	0002	R	PRODUCT CODE	HW	unsigned int	1		0x 0001	88498 decimal
4	0003	R		LW	unsigned int	1		0x 59B2	
5	0004	R	BARCODE CONTROL		unsigned int	1		8	
6	0005	R	SOFTWARE VERSION		unsigned int	1		0x 0220	
7	0006	R/W	DEVICE NUMBER	HW	unsigned int	1		0x FFFF - 0x 0000	
8	0007	R/W		LW	unsigned int	1		0x FFFF - 0x 0000	
			INSTANTANEOUS VALUES						
1	1000	R	CURRENT TRANSFORMER RATIO **(ATRF)**		unsigned int	1	ATRF	1 - 2000	
2	1001	R	VOLTAGE TRANSFORMER RATIO **(GTRF)**		unsigned int	0,1	GTRF	10 - 10000	
3	1002	R	PHASE 1 VOLTAGE Phase-Neutral	(VL_{1N})	unsigned int	0,1 x (GTRF)	VOLT	((VL_{1N}) x GTRF x 0,1); example:If GTRF=1 ; 2200 x(1 x 0,1) = 220 Volt	
4	1003	R	PHASE 2 VOLTAGE Phase-Neutral	(VL_{2N})	unsigned int	0,1 x (GTRF)	VOLT		
5	1004	R	PHASE 3 VOLTAGE Phase-Neutral	(VL_{3N})	unsigned int	0,1 x (GTRF)	VOLT		
6	1005	R	PHASES 1-2 VOLTAGE Phase-phase	(VL_{12})	unsigned int	0,1 x (GTRF)	VOLT		
7	1006	R	PHASES 1-3 VOLTAGE Phase-phase	(VL_{13})	unsigned int	0,1 x (GTRF)	VOLT		
8	1007	R	PHASES 2-3 VOLTAGE Phase-phase	(VL_{23})	unsigned int	0,1 x (GTRF)	VOLT		
9	1008	R	PHASE 1 CURRENT	(I1)	unsigned int	(ATRF) x 0,001	AMPER	(I1 x ATRF x 0,001); Example:If 100/5A ; 5000 x(20 x 0,001) = 100 A	
10	1009	R	PHASE 2 CURRENT	(I2)	unsigned int	(ATRF) x 0,001	AMPER	(I2 x ATRF x 0,001)	
11	100A	R	PHASE 3 CURRENT	(I3)	unsigned int	(ATRF) x 0,001	AMPER	(I3 x ATRF x 0,001)	
12	100B	R	PHASE 1 ACTIVE POWER	(P1)	unsigned int	(ATRF) x (GTRF)	WATT	(P1 x (ATRF) x (GTRF))	
13	100C	R	PHASE 2 ACTIVE POWER	(P2)	unsigned int	(ATRF) x (GTRF)	WATT	(P2 x (ATRF) x (GTRF))	
14	100D	R	PHASE 3 ACTIVE POWER	(P3)	unsigned int	(ATRF) x (GTRF)	WATT	(P2 x (ATRF) x (GTRF))	
15	100E	R	PHASE 1 REACTIVE POWER	(Q1)	signed int	(ATRF) x (GTRF)	VAR	(Q1 x (ATRF) x (GTRF))	
16	100F	R	PHASE 2 REACTIVE POWER	(Q2)	signed int	(ATRF) x (GTRF)	VAR	(Q2 x (ATRF) x (GTRF))	
17	1010	R	PHASE 3 REACTIVE POWER	(Q3)	signed int	(ATRF) x (GTRF)	VAR	(Q3 x (ATRF) x (GTRF))	
18	1011	R	PHASE 1 APPARENT POWER	(S1)	unsigned int	(ATRF) x (GTRF)	VA	(S1 x (ATRF) x (GTRF))	
19	1012	R	PHASE 2 APPARENT POWER	(S2)	unsigned int	(ATRF) x (GTRF)	VA	(S2 x (ATRF) x (GTRF))	
20	1013	R	PHASE 3 APPARENT POWER	(S3)	unsigned int	(ATRF) x (GTRF)	VA	(S3 x (ATRF) x (GTRF))	
21	1014	R	PHASE 1 COSØ	(COSØ1)	signed int	0,01	-	(COSØ1 x 0,01)	
22	1015	R	PHASE 2 COSØ	(COSØ2)	signed int	0,01	-	(COSØ2 x 0,01)	
23	1016	R	PHASE 3 COSØ	(COSØ3)	signed int	0,01	-	(COSØ3 x 0,01)	
24	1017	R	TOTAL COSØ	($\overrightarrow{COS\emptyset}$)	signed int	0,01	-	($\overrightarrow{COS\emptyset}$ x 0,01)	
25	1018	R	TOTAL ACTIVE POWER	(ΣP)	unsigned int	(ATRF) x (GTRF)	WATT	((ΣP) x (ATRF) x (GTRF))	
26	1019	R	TOTAL REACTIVE POWER VECTOR	($\overrightarrow{\Sigma Q}$)	signed int	(ATRF) x (GTRF)	VAR		
27	101A	R	FREQUENCY	(f)	unsigned int	0,1	Hz	(f x 0,1)	
28	**101B**	**R**	TOTAL APPARENT POWER	(ΣS)	**unsigned int**	**(ATRF) x (GTRF)**	VA	((ΣS) x (ATRF) x (GTRF))	
29	101C	R	REACTIVE POWER DIRECTION BITS		unsigned int	1	-	**Bit 0:** Direction of phase 1 ("1" = capacitive , "0" = inductive) **Bit 1:** Direction of phase 2 ("1" = capacitive , "0" = inductive) **Bit 2:** Direction of phase 3 ("1" = capacitive , "0" = inductive) **Bit 3:** Direction of total reactive power ("1" = capacitive , "0" = inductive) **NOT:** Bit4,.....Bit15 reserve READ "0"	
30	101D	R	CURRENT TRANSFORMERS DIRECTION BITS		unsigned int	1	-	**Bit 0:** Current direction of phase 1 (if it is "1", reverse) **Bit 1:** Current direction of phase 2 (if it is "1", reverse) **Bit 2:** Current direction of phase 3 (if is "1", reverse) **Bit 3:** determination of current direction phase 1 (if it is "1", determined) **Bit 4:** determination of current direction phase 2 (if it is "1", determined) **Bit 5:** determination of current direction phase 3 (if it is "1", determined) **NOT:** Bit6,.....Bit15 reserve READ "0"	
31	101E		TOTAL INDUCTIVE POWER	(ΣQind)	signed int	(ATRF) x (GTRF)	VAR		
32	101F		TOTAL CAPACITIVE POWER	(ΣQkap)	signed int	(ATRF) x (GTRF)	VAR		
33	1020		TOTAL REACTIVE POWER	(ΣQ)	unsigned int	(ATRF) x (GTRF)	VAR		

REGISTER TABLE

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NO	ADRES (HEX)	(R)read (W)write	PARAMETER	FORMAT	MULTIPLIER	UNIT	INSTRUCTION
			DEMANDS				
1	2000	R	CURRENT TRANSFORMER RATIO **(ATRF)**	unsigned int	1	ATRF	1 - 2000
2	2001	R	VOLTAGE TRANSFORMER RATIO **(GTRF)**	unsigned int	0,1	GTRF	10 - 10000
3	2002	R	PHASE 1 VOLTAGE Phase-Neutral (VL_{1N})	unsigned int	0,1 x (GTRF)	VOLT	Demand Value
4	2003	R	PHASE 2 VOLTAGE Phase-Neutral (VL_{2N})	unsigned int	0,1 x (GTRF)	VOLT	Demand Value
5	2004	R	PHASE 3 VOLTAGE Phase-Neutral (VL_{3N})	unsigned int	0,1 x (GTRF)	VOLT	Demand Value
6	2005	R	PHASES 1-2 VOLTAGE Phase-phase (VL_{12})	unsigned int	0,1 x (GTRF)	VOLT	Demand Value
7	2006	R	PHASES 1-3 VOLTAGE Phase-phase (VL_{13})	unsigned int	0,1 x (GTRF)	VOLT	Demand Value
8	2007	R	PHASES 2-3 VOLTAGE Phase-phase (VL_{23})	unsigned int	0,1 x (GTRF)	VOLT	Demand Value
9	2008	R	PHASE 1 CURRENT (I1) demand	unsigned int	(ATRF) x 0,001	AMPER	Demand Value
10	2009	R	PHASE 2 CURRENT (I2) demand	unsigned int	(ATRF) x 0,001	AMPER	Demand Value
11	200A	R	PHASE 3 CURRENT (I3) demand	unsigned int	(ATRF) x 0,001	AMPER	Demand Value
12	200B	R	PHASE 1 ACTIVE POWER (P1) demand	unsigned int	(ATRF) x (GTRF)	WATT	Demand Value
13	200C	R	PHASE 2 ACTIVE POWER (P2) demand	unsigned int	(ATRF) x (GTRF)	WATT	Demand Value
14	200D	R	PHASE 3 ACTIVE POWER (P3) demand	unsigned int	(ATRF) x (GTRF)	WATT	Demand Value
15	200E	R	PHASE 1 REACTIVE POWER (Q1) ind	signed int	(ATRF) x (GTRF)	VAR	Demand Value
16	200F	R	PHASE 2 REACTIVE POWER (Q2) ind	signed int	(ATRF) x (GTRF)	VAR	Demand Value
17	2010	R	PHASE 3 REACTIVE POWER (Q3) ind	signed int	(ATRF) x (GTRF)	VAR	Demand Value
18	2011	R	PHASE 1 REACTIVE POWER (Q1) cap	signed int	(ATRF) x (GTRF)	VAR	Demand Value
19	2012	R	PHASE 2 REACTIVE POWER (Q2) cap	signed int	(ATRF) x (GTRF)	VAR	Demand Value
20	2013	R	PHASE 3 REACTIVE POWER (Q3) cap	signed int	(ATRF) x (GTRF)	VAR	Demand Value
21	2014	R	PHASE 1 APPARENT POWER (S1)	unsigned int	(ATRF) x (GTRF)	VA	Demand Value
22	2015	R	PHASE 2 APPARENT POWER (S2)	unsigned int	(ATRF) x (GTRF)	VA	Demand Value
23	2016	R	PHASE 3 APPARENT POWER (S3)	unsigned int	(ATRF) x (GTRF)	VA	Demand Value
24	2017	R	PHASE 1 COSØ (COSØ1) ind	signed int	0,01	-	Demand Value
25	2018	R	PHASE 2 COSØ (COSØ2) ind	signed int	0,01	-	Demand Value
26	2019	R	PHASE 3 COSØ (COSØ3) ind	signed int	0,01	-	Demand Value
27	201A	R	PHASE 1 COSØ (COSØ1) cap	signed int	0,01	-	Demand Value
28	201B	R	PHASE 2 COSØ (COSØ2) cap	signed int	0,01	-	Demand Value
29	201C	R	PHASE 3 COSØ (COSØ3) cap	signed int	0,01	-	Demand Value

NO	ADRES (HEX)	(R)read (W)write	PARAMETER	FORMAT	MULTIPLIER	UNIT	INSTRUCTION
			PEAK VALUES				
1	3000	R	CURRENT TRANSFORMER RATIO **(ATRF)**	unsigned int	1	ATRF	1 - 2000
2	3001	R	VOLTAGE TRANSFORMER RATIO **(GTRF)**	unsigned int	0,1	GTRF	10 - 10000
3	3002	R	PHASE 1 VOLTAGE Phase-Neutral (VL_{1N})	unsigned int	0,1 x (GTRF)	VOLT	Peak value
4	3003	R	PHASE 2 VOLTAGE Phase-Neutral (VL_{2N})	unsigned int	0,1 x (GTRF)	VOLT	Peak value
5	3004	R	PHASE 3 VOLTAGE Phase-Neutral (VL_{3N})	unsigned int	0,1 x (GTRF)	VOLT	Peak value
6	3005	R	PHASES 1-2 VOLTAGE Phase-phase (VL_{12})	unsigned int	0,1 x (GTRF)	VOLT	Peak value
7	3006	R	PHASES 1-3 VOLTAGE Phase-phase (VL_{13})	unsigned int	0,1 x (GTRF)	VOLT	Peak value
8	3007	R	PHASES 2-3 VOLTAGE Phase-phase (VL_{23})	unsigned int	0,1 x (GTRF)	VOLT	Peak value
9	3008	R	PHASE 1 CURRENT (I1) peak	unsigned int	(ATRF) x 0,001	AMPER	Peak value
10	3009	R	PHASE 2 CURRENT (I2) peak	unsigned int	(ATRF) x 0,001	AMPER	Peak value
11	300A	R	PHASE 3 CURRENT (I3) peak	unsigned int	(ATRF) x 0,001	AMPER	Peak value
12	300B	R	PHASE 1 ACTIVE POWER (P1) peak	unsigned int	(ATRF) x (GTRF)	WATT	Peak value
13	300C	R	PHASE 2 ACTIVE POWER (P2) peak	unsigned int	(ATRF) x (GTRF)	WATT	Peak value
14	300D	R	PHASE 3 ACTIVE POWER (P3) peak	unsigned int	(ATRF) x (GTRF)	WATT	Peak value
15	300E	R	PHASE 1 REACTIVE POWER (Q1) ind	signed int	(ATRF) x (GTRF)	VAR	Peak value
16	300F	R	PHASE 2 REACTIVE POWER (Q2) ind	signed int	(ATRF) x (GTRF)	VAR	Peak value
17	3010	R	PHASE 3 REACTIVE POWER (Q3) ind	signed int	(ATRF) x (GTRF)	VAR	Peak value
18	3011	R	PHASE 1 REACTIVE POWER (Q1) cap	signed int	(ATRF) x (GTRF)	VAR	Peak value
19	3012	R	PHASE 2 REACTIVE POWER (Q2) cap	signed int	(ATRF) x (GTRF)	VAR	Peak value
20	3013	R	PHASE 3 REACTIVE POWER (Q3) cap	signed int	(ATRF) x (GTRF)	VAR	Peak value
21	3014	R	PHASE 1 APPARENT POWER (S1)	unsigned int	(ATRF) x (GTRF)	VA	Peak value
22	3015	R	PHASE 2 APPARENT POWER (S2)	unsigned int	(ATRF) x (GTRF)	VA	Peak value
23	3016	R	PHASE 3 APPARENT POWER (S3)	unsigned int	(ATRF) x (GTRF)	VA	Peak value
24	3017	R	PHASE 1 COSØ (COSØ1) ind	signed int	0,01	-	Peak value
25	3018	R	PHASE 2 COSØ (COSØ2) ind	signed int	0,01	-	Peak value
26	3019	R	PHASE 3 COSØ (COSØ3) ind	signed int	0,01	-	Peak value
27	301A	R	PHASE 1 COSØ (COSØ1) cap	signed int	0,01	-	Peak value
28	301B	R	PHASE 2 COSØ (COSØ2) cap	signed int	0,01	-	Peak value
29	301C	R	PHASE 3 COSØ (COSØ3) cap	signed int	0,01	-	Peak value

REGISTER TABLOSU

>>>> Page

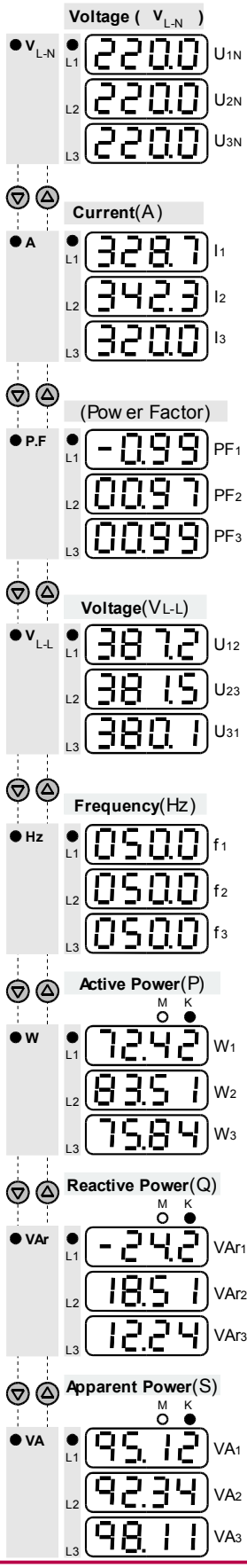
NO	ADRES (HEX)	(R)read (W)write	PARAMETER	FORMAT	MULTIPLIER	UNIT	INSTRUCTION
			ENERGY COUNTERS				
1	4000	R	TIMER	unsigned int	1	sec	HIGH WORD
2	4001	R	TIMER	unsigned int	1	sec	LOW WORD
3	4002	R	ACTIVE ENERGY COUNTER	unsigned int	1	GW/h	GIGA WATT hour digits
4	4003	R	ACTIVE ENERGY COUNTER	unsigned int	1	MW/h	MEGA WATT hour digits
5	4004	R	ACTIVE ENERGY COUNTER	unsigned int	1	KW/h	KILO WATT hour digits
6	4005	R	ACTIVE ENERGY COUNTER	unsigned int	1	W/h	WATT hour digits
7	4006	R	ACTIVE ENERGY COUNTER	unsigned int	1	mW/h	mili WATT hour digits
8	4007	R	ACTIVE ENERGY COUNTER	unsigned int	1	W/s	WATT second digits
9	4008	R	REACTIVE (INDUCTIVE) ENERGY COUNTER	unsigned int	1	GVAR/h	GIGA VAR hour digits
10	4009	R	REACTIVE (INDUCTIVE) ENERGY COUNTER	unsigned int	1	MVAR/h	MEGA VAR hour digits
11	400A	R	REACTIVE (INDUCTIVE) ENERGY COUNTER	unsigned int	1	KVAR/h	KILO VAR hour digits
12	400B	R	REACTIVE (INDUCTIVE) ENERGY COUNTER	unsigned int	1	VAR/h	VAR hour digits
13	400C	R	REACTIVE (INDUCTIVE) ENERGY COUNTER	unsigned int	1	mVAR/h	mili VAR hour digits
14	400D	R	REACTIVE (INDUCTIVE) ENERGY COUNTER	unsigned int	1	VAR/s	VAR second digits
15	400E	R	REACTIVE (CAPACITIVE) ENERGY COUNTER	unsigned int	1	GVAR/h	GIGA VAR hour digits
16	400F	R	REACTIVE (CAPACITIVE) ENERGY COUNTER	unsigned int	1	MVAR/h	MEGA VAR hour digits
17	4010	R	REACTIVE (CAPACITIVE) ENERGY COUNTER	unsigned int	1	KVAR/h	KILO VAR hour digits
18	4011	R	REACTIVE (CAPACITIVE) ENERGY COUNTER	unsigned int	1	VAR/h	VAR hour digits
19	4012	R	REACTIVE (CAPACITIVE) ENERGY COUNTER	unsigned int	1	mVAR/h	mili VAR hour digits
20	4013	R	REACTIVE (CAPACITIVE) ENERGY COUNTER	unsigned int	1	VAR/s	VAR second digits
21	4014	R	REACTIVE ENERGY COUNTER	unsigned int	1	GVAR/h	GIGA VAR hour digits
22	4015	R	REACTIVE ENERGY COUNTER	unsigned int	1	MVAR/h	MEGA VAR hour digits
23	4016	R	REACTIVE ENERGY COUNTER	unsigned int	1	KVAR/h	KILO VAR hour digits
24	4017	R	REACTIVE ENERGY COUNTER	unsigned int	1	VAR/h	VAR hour digits
25	4018	R	REACTIVE ENERGY COUNTER	unsigned int	1	mVAR/h	mili VAR hour digits
26	4019	R	REACTIVE ENERGY COUNTER	unsigned int	1	VAR/sn	VAR second digits
27	401A	R	APPARENT ENERGY COUNTER	unsigned int	1	GVA/h	GIGA VA hour digits
28	401B	R	APPARENT ENERGY COUNTER	unsigned int	1	MVA/h	MEGA VA hour digits
29	401C	R	APPARENT ENERGY COUNTER	unsigned int	1	KVA/h	KILO VA hour digits
30	401D	R	APPARENT ENERGY COUNTER	unsigned int	1	VA/h	VA hour digits
31	401E	R	APPARENT ENERGY COUNTER	unsigned int	1	mVA/h	mili VA hour digits
32	401F	R	APPARENT ENERGY COUNTER	unsigned int	1	VA/s	VA second digits
			PARAMETERS				
1	5000	R/W	CURRENT TRANSFORMER RATIO **(ATRF)**	unsigned int	1	ATRF	1 - 2000
2	5001	R/W	VOLTAGE TRANSFORMER RATIO **(GTRF)**	unsigned int	0,1	GTRF	10 - 10000
3	5002	R/W	ENERGY COUNTER TYPE	unsigned int	1	-	1 = seperately , 0 =Vector sum
4	5003	R/W	DEMAND TIME	unsigned int	1	minute	5 – 60 minutes
5	5004	R/W	AUTOMATIC CURRENT DIRECTION FUNCTION	unsigned int	1	-	If this bit is "0" function is enable . If this bit is "1" function is disable.
6	5005	R/W	DEVICE ADRESS	unsigned int	1	-	1 – 255
7	5006	R/W	ERASING FUNCTION BITS relating to bit if set "1" ,erase If bit set "1" which is related values will be erase	unsigned int	1	-	**Bit 0:**If bit set then It erases phase-neutral voltage demand and peak values. **Bit 1:**If bit set then It erases current demand and peak values. **Bit 2:**If bit set then It erases CosØ demand and peak values. **Bit 3:**If bit set then It erases phase-phase voltage demand and peak values **Bit 4:**If bit set then It erases active power demand and peak values. **Bit 5:**If bit set then It erases reactive power demand and peak values. **Bit 6:**If bit set then It erases apparent power demand and peak values. **Bit 7:**All energy counters will be erase. **Bit 8:**All values which is given above will be erase. **NOT:** Bit9,.....Bit15 reserve READ "0"

MULTIMET-01-96 Multimeter & Power Meter

KAEL

SPECIFICATIONS

- Microprocessor based
- Measurement of 3 phase electrical quantities (VL-N, A, CosΦ, VL-L, Hz, W, VAr, VA)
- Correct learning of current transformer polarity (even if (k,l) is connected in reverse direction)
- Setting of current and voltage transformer ratios
- Easy access to menus
- Reduces both number of measurement equipment used in the panel and connection time
- Lowers electrical panel costs



General

Multimet gives the ability of tracking electrical parameters for 3 phase systems such as, phase currents, phase-neutral & phase-phase voltages, frequency, power factor, active powers, reactive powers and apparent powers.

Current and voltage transformer ratios can be set by the user. Using the directions buttons, desired parameters can be accessed easily.
On the other hand, its displays make it possible to track values from long distance.

MEASURED ELECTRICAL PARAMETERS

(VL-N, A, CosΦ, VL-L, Hz, W, VAr, VA)
Using the direction buttons, above parameters are easily accessed step by step. Appropriate LED lights on and value of each phase is showed on the display at the same time instant.

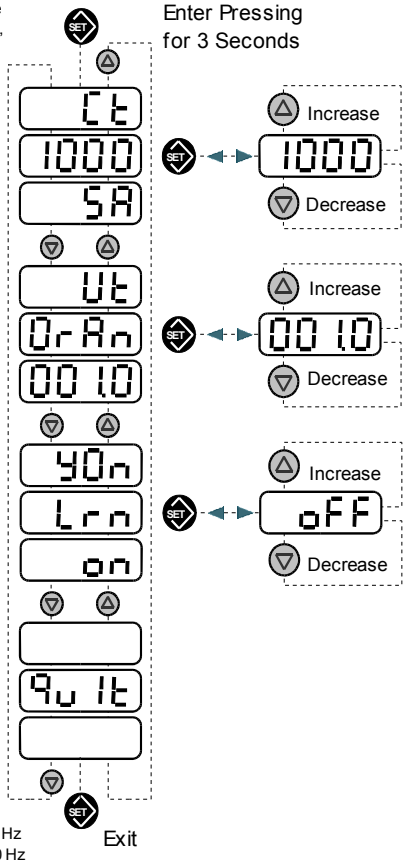
ACCESSING PARAMETERS:
Using the direction buttons, it is possible to move up and down in the menu. When set button is pressed down for 3 seconds, parameter setting menu is accessed and to set any of the parameters, first set button is pressed, then using the directions buttons, value is increased/decreased. When desired value is reached, it is stored by pressing the set button. Using the direction buttons.

Ct: Current transformer value : (5...10000)
The current tranformer's primary value shouldbe entered. For example if 500/5A cuurent is used then 500 must be entered.

Ut: Voltage transformer value : (1...1000)
If no voltage transformer is used, this parameter must be left as 1.

YOn Lrn: Current transformer polarity direction learning: (on – oFF)
If it is " on " then the device would learn the direction automatically. If the device monted in new panel or the polarity somehow changed then it learns the new direction. If off then the device would learn the direction once and never learn it again. Off position is required for some loads. If there would be a problem in the current transformer direction then the current transformer inputs shuld be switched.

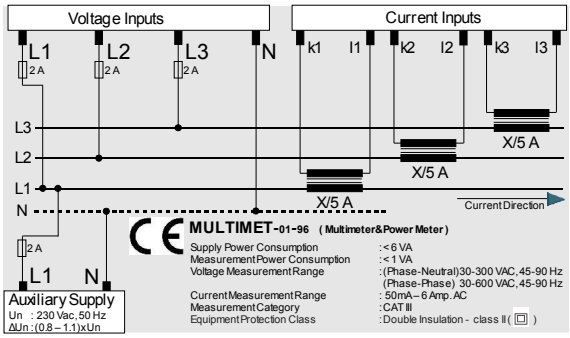
Note: If no button is pressed for 4 minutes under this menu, devices automatically quits programming menu.



TECHNICAL DATA:

Rated Voltage (Un)	: 220 VAC
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 Hz
Supply Power Consumption	: < 6 VA
Measurement Power Consumption	: < 1 VA
Voltage Measurement Range	: (Phase-Neutral) 30-300 VAC, 45-90 Hz (Phase-Phase) 30-600 VAC, 45-90 Hz
Current Measurement Range	: (Secondary current) 50mA – 6 Amp. AC
Display Range	: 0 – 999.9 kV 0 – 999.9 M (W, VAr, VA) (Cosφ) 0.00 – 1.00 ind. & cap.
Minimum Measurement Values	: 50 mA, 30V
Measurement Sensitivity	: 1% ± digit
Voltage Transformer Ratio	: 1 1000
Current Transformer Ratio	: 5/5 ..... 10000/5 A
Display	: 4 Digits LED display
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 96x96x80 mm

Connection :



MULTIMET-02-96 Multimeter

SPECIFICATIONS

- Microprocessor based
- Measurement of 3 phase electrical quantities (VL-N, A, CosΦ, VL-L, Hz)
- Correct learning of current transformer polarity (even if (k,l) is connected in reverse direction)
- Setting of current and voltage transformer ratios
- Easy access to menus
- Reduces both number of measurement equipment used in the panel and connection time
- Lowers electrical panel costs

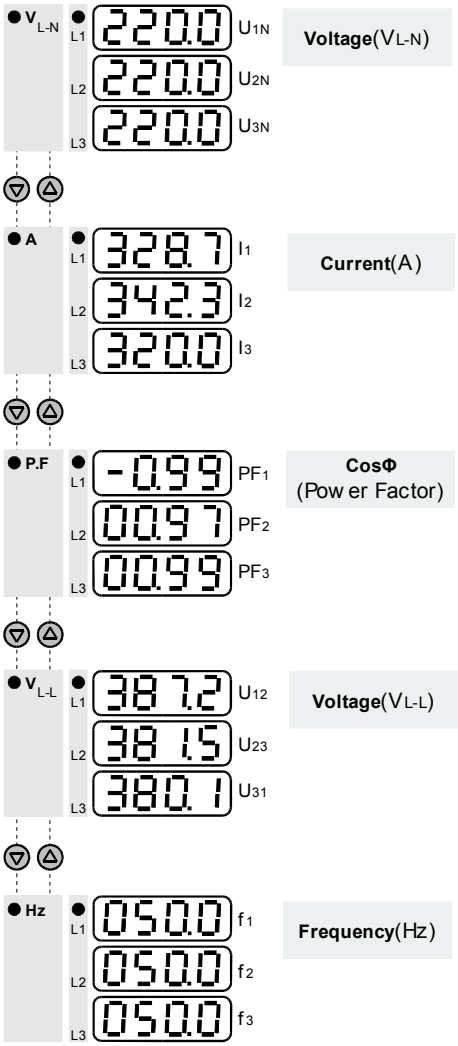
96x96

General

Multimet gives the ability of tracking electrical parameters for 3 phase systems such as, phase currents, phase-neutral & phase-phase voltages, frequency and power factors.Current and voltage transformer ratios can be set by the user. Using the directions buttons, desired parameters can be accessed easily. On the other hand, its displays make it possible to track values from long distance.

MEASURED ELECTRICAL PARAMETERS (VL-N, A, CosΦ, VL-L, Hz)

Using the direction buttons, above parameters are easily accessed step by step. Appropriate LED lights on and value of each phase is showed on the display at the same time instant.



ACCESSING PARAMETERS:

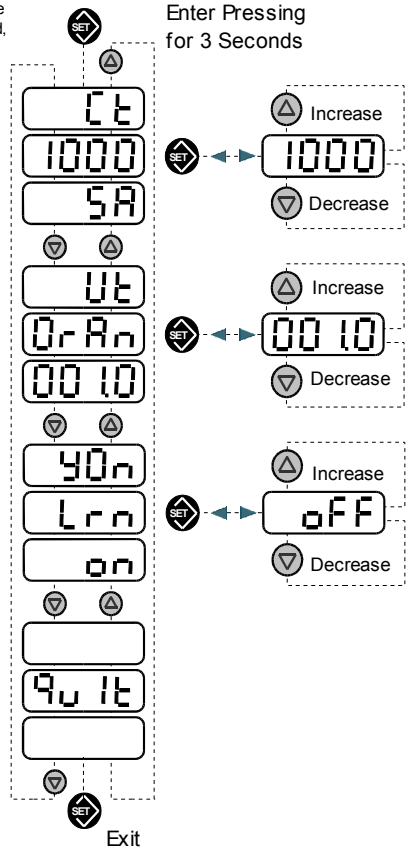
Using the direction buttons, it is possible to move up and down in the menu. When set button is pressed down for 3 seconds, parameter setting menu is accessed and to set any of the parameters, first set button is pressed, then using the directions buttons, value is increased/decreased. When desired value is reached, it is stored by pressing the set button. Using the direction buttons.

Ct: Current transformer value : (5...10000)
The current tranformer's primary value shouldbe entered. For example if 500/5A cuurent is used then 500 must be entered.

Ut: Voltage transformer value : (1...1000)
If no voltage transformer is used, this parameter must be left as 1.

YOn Lrn: Current transformer polarity direction learning: (on – oFF)
If it is " on " then the device would learn the direction automatically. If the device monted in new panel or the polarity somehow changed then it learns the new direction. If off then the device would learn the direction once and never learn it again. Off position is required for some loads. If there would be a problem in the current transformer direction then the current transformer inputs shuld be switched.

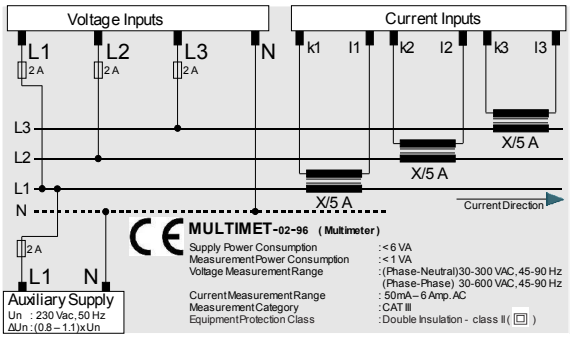
Note: If no button is pressed for 4 minutes under this menu, devices automatically quits programming menu.



TECHNICAL DATA:

Rated Voltage (Un)	: 220 VAC
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 Hz
Supply Power Consumption	: < 6 VA
Measurement Power Consumption	: < 1 VA
Voltage Measurement Range	: (Phase-Neutral) 30-300 VAC, 45-90 Hz (Phase-Phase) 30-600 VAC, 45-90 Hz
Current Measurement Range	: (Secondary current) 50mA – 6 Amp. AC
Display Range	: 0 – 999.9 kV (Cosφ) 0.00 – 1.00 ind. & cap.
Minimum Measurement Values	: 50 mA, 30V
Measurement Sensitivity	: 1% ± digit
Voltage Transformer Ratio	: 1 1000
Current Transformer Ratio	: 5/5 ..... 10000/5 A
Display	: 4 Digits LED display
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 96x96x80 mm

Connection :



MULTIMET-03-96

Multimeter

A	IL1, IL2, IL3
V	VL1N, VL2N, VL3N VL12, VL13,VL23
Hz	
TRUE RMS	
Reduced Price	

SPECIFICATIONS

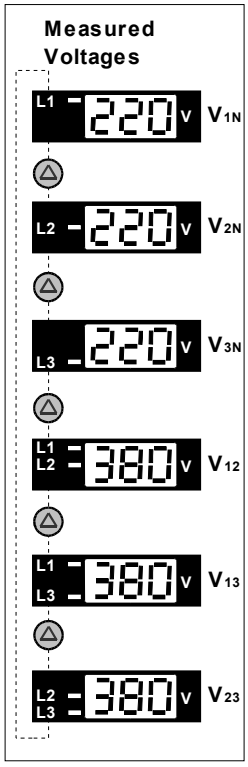
-Microprocessor based
-Measurement of 3 phase electrical quantities (VL-N, A, VL-L, Hz)
-Setting of current and voltage transformer ratios
-Easy Access to menu
-Reduces both number of measurement equipment used in the panel and connection time.
-Low er Electrical panel costs.

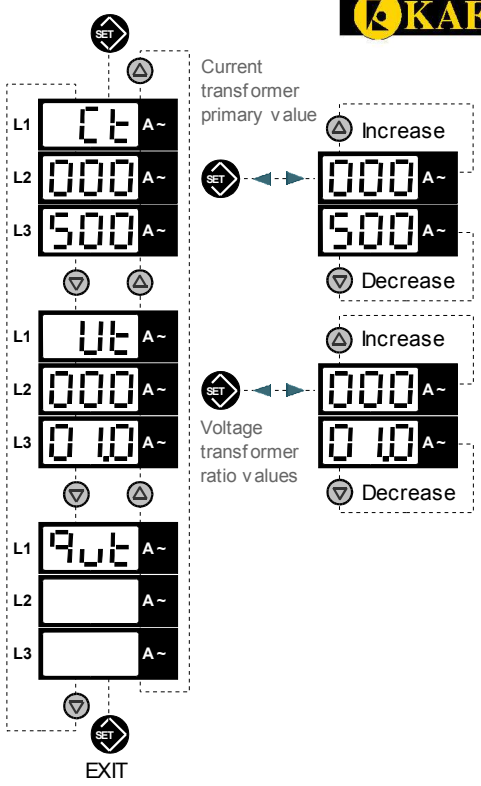
General

Multimet gives the ability of tracking electrical parameters for 3 phase systems such as, phase currents, phase-neutral & phase-phase voltages, frequency .Current and voltage transformer ratios can be set by the user.

Using the directions buttons, desired parameters can be accessed easily .

On the other hand, its display s make it possible to track values from long distance.

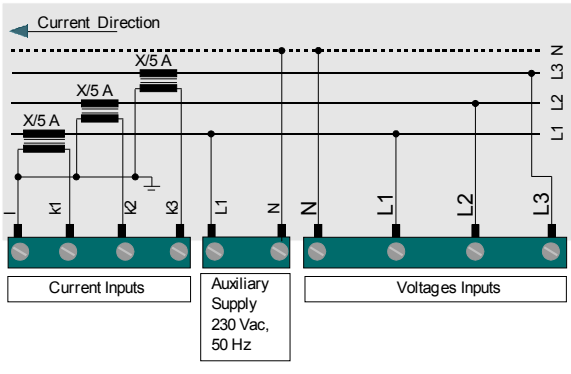




ACCESSING PARAMETERS:
Using the direction buttons, it is possible to move up and dow n in the menu. When set button is pressed dow n for 3 seconds, parameter setting menu is accessed and to set any of the parameters, first set button is pressed, then using the directions buttons, value is increased or decreased. When desired value is reached, it is stored by pressing the set button. Using the direction buttons.
Ct: Current transformer value : (5...10000)
The current tranformer's primary value should be entered. For example if 500/5A cuurent is used then 500 must be entered.
Ut: Voltage transformer value : (1...1000)
If no voltage transformer is used, this parameter must be left as 1.

TECHNICAL DATA:

Rated Voltage (Un)	: 220 VAC
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 Hz
Supply Power Consumption	: < 6 VA
Measurement Power Consumption	: < 1 VA
Voltage Measurement Range	: (Phase-Neutral) 30-300 VAC, 45-90 Hz (Phase-Phase) 30-600 VAC, 45-90 Hz
Current Measurement Range	: (Secondary current)50mA – 6 Amp.ac
Minimum Measurement Values	: 50 mA, 30V
Measurement Sensitivity	: %1±1 dijit
Voltage Transformer Ratio	: 1 1000
Current Transformer Ratio	: 5/5 ..... 10000/5 A
Dev ice Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 96x96x80 mm



DP-01-96 Digital Protector & Multimeter

Current & Voltage Protection

96 X 96

SPECIFICATIONS :

- Microprocessor controlled,
- 3 Phase current and voltage control
- Selectable three program modes;
  * Prg1 ; System Protection
  * Prg2 ; Motor Protection
  * Prg3 ; Full Protection
- Two different relay outputs for current and voltage alarms,
- Gives the ability to activate or deactivate one, some or all alarms independently, The active alarms control the relay outputs while the inactive ones only turns the alarm leds on,
- Has password protection to prevent unauthorized people from changing the system settings,
- Measures the following 3 phase electrical amplitudes (VL-N, A, CosΦ, W)
- Correct learning of polarity of the current transformer (even if (k,l) were connected in reverse direction),
- Gives the ability to input current and voltage trasformers' ratios,
- Over & Under voltage control,
- Asymmetric voltage control (% 5 – 40 Phase-Neutral)
- Over current control,
- Under current control,
- Asymmetric current control (% 5 – 50)
- Has the property of sudden switch off its contacts when current or voltage is missing,
- Automatic-manual options,
- Easy Access to menus,
- Reduces the number of equipments in the panel and saves assembling time,
- Reduces the panel's cost.

1. General

Works as taking samples from three current and vlotage phases and shows these electrical amplitudes on its screen. The user has the opportunity for selecting type protect a system or a motor, also the user can select to reset automatically or manually.
When automatic reset is selected, the system will automatically switch on the contacts after the failure is over. When manual reset is selected, the system will not switch on its contacts until the operator resets it.

1.1 Protection Programs

1.1.1 System Protection: Prog 1

Protects the system it is connected to from over voltage, under voltage, asymmetric voltage and over current. The sudden switch off (Iset x 1.5) is active. It can be used in electric distribution panels for protection. On this mode, under current, asymetric current protections and start delay time are unfunctional.

1.1.2 Motor Protection : Prog 2

Protects a motor from over voltage, under voltage, asymmetric voltage, over current and asymmetric current. The sudden switch off (Iset x 1.5) is active. To avoid the effects of inrush currents the device has a start delay. On this mode, only under current is unfunctional.

1.1.3 Full Protection : Prog 3

Protects a system from over voltage, under voltage, asymmetric voltage, over current, under current and asymmetric current. The sudden switch off (Iset x 1.5) is active, and the system has start delay.

1.2 The Use Of The Alarms

User can disable any alarm he does not want to use. To do that he must access the alarms from the menu and disable them. The disabled alarms will not affect the relay's function (switch on or off). When one of the disabled alarms occurs, only the related alarm led will blink to alert the operator.
The active alarms will keep controlling the output contacts.
The thing that must be awared of is that when all alarms are disabled the system will be unprotected and the output contacts will be always on.

1.3 The Use Of Password

The device has a changeable password to make an easy access to the menu. The password prevents unauthorized people from changing the system setting. Incase of wrong password input, the user can go through the menu and view the set values but can not change these values.
Correct password input allows the user to go through the menu and change any adjusted value. The first use value is “1234”.

2. Protections:

2.1 Over Voltage Protection:

The over voltage limit can be set by the user between 230 and 270 volts. When the Neutral-Phase voltage of the protected system exceeds the adjusted value the device switches off its output contacts after a proper time (t3). If the voltage returns to normal value before the end of the (t3) period then the switch off does not happen. After a switch off of an over voltage alarm, while automatic reset is selected, if the voltage value returns to the normal value then switch on occurs after a proper period (T-on). If manual reset is selected, the switch off will continue until the operator pushes the reset button. Pressing the set button for 3 seconds resets the device.

2.2 Under Voltage Protection:

The under voltage limit can be set by the user between 170 and 210 volts. When the Neutral-Phase voltage of the protected system exceeds the adjusted value the device switches off its output contacts after a proper time (t3). If the voltage returns to normal value before the end of the (t3) period then the switch off does not happen. After a switch off of an under voltage alarm, while automatic reset is selected, if the voltage value returns to the normal value then switch on occurs after a proper period (T-on). If manual reset is selected, the switch off will continue until the operator pushes the reset button. Pressing the set button for 3 seconds resets the device.

2.3 Asymmetric Voltage Protection:

It can be set by the user between %5 and %40. When an unbalance occurs between the phases then the device switches off the output contact after the t3 time. If the unbalance returns to normal value before the end of the (t3) period then the switch off does not happen. After a switch off of an asymmetric voltage alarm, while automatic reset is selected, if the voltage value returns to the normal value then switch on occurs after a proper period (T-on). If manual reset is selected, the switch off will continue until the operator pushes the reset button. Pressing the set button for 3 seconds resets the device.

2.4 Over Current Protection:

The current limit can be set by the user between x 0.1 and x 1 of the current transformer value. When any current passing through any phase of the protected system exceeds the adjusted value the device switches off its output contacts after a proper time (t2). If the current value goes over 1.5 times over the adjusted current value the device will wait for no delay and switches the output contacts immediately. The over current protection goes active after the start delay time in motor and full protection modes (Pgr2 and Pgr3), while in system protection mode (Pgr1) no start delay time is applied then the over current protection starts immediately. After a switch off of an over current alarm, while automatic reset is selected, if the current value returns to the normal value then switch on occurs after a proper period (T-on). If manual reset is selected, the switch off will continue until the operator pushes the reset button. Pressing the set button for 3 seconds resets the device.

2.5 Current Sudden Switch Off Protection:

It can be set by the user between (I)s x2 and (I)s x10 of the over current value. When the current value exceeds the adjusted value within the start delay time, the device switches off its output contact immediately. This Protection is active in all program modes. After a switch off of a current sudden swtich off alarm, while automatic reset is selected, if the current value returns to the normal value or to zero value then switch on occurs after a proper period (T-on). If manual reset is selected, the switch off will continue until the operator pushes the reset button. Pressing the set button for 3 seconds resets the device.

2.6 Asymmetric Current Protection:

It can be set by the user between %5 and %50. Works on motor Protection and full protection (Pgr2 and Pgr3) only. It controls the asymmetric that may occur in the current of the three phases. That may occur when one of the phases' voltage is low and the other one ishigh. That may cause asymmetric current in the motor's bobbin. This way the motor's bobbin is protected. Furthermore it protects the motor from missing phase or a possible unplugged or cut wiring. After a switch off of a asymmetric current alarm, while automatic reset is selected, if the current value returns to the normal value or to zero value then switch on occurs after a proper period (T-on). If manual reset is selected, the switch off will continue until the operator pushes the reset button. Pressing the set button for 3 seconds resets the device.

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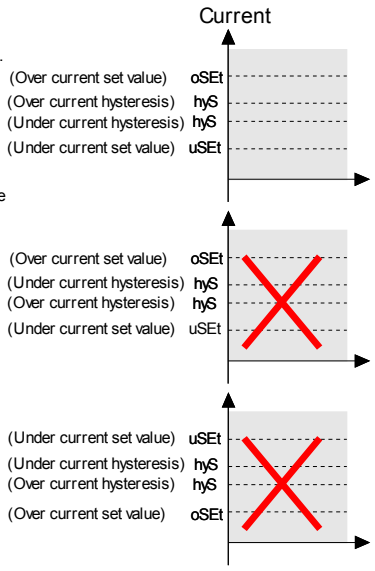
Current & Voltage Protection

2.7 Under Current Protection:

It can be set by the user between x 0.1 and x 1 of the current transformer value.
It works only on full protection mode (Prg2).
When the current of the protected motor goes below the adjusted value it switches off its output contact after t2 delay.
It goes active after the start delay ends.
After a switch off of an under current alarm, while automatic reset is selected, if the current value returns to the normal value or zero value then switch on occurs after a proper period (T-on). If manual reset is selected, the switch off will continue until the operator pushes the reset button.
Pressing the set button for 3 seconds resets the device.

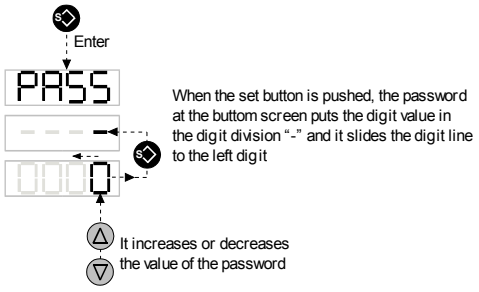

Current
(Over current set value) oSEt
(Over current hysteresis) hyS
(Under current hysteresis) hyS
(Under current set value) uSEt
(Over current set value) oSEt
(Under current hysteresis) hyS
(Over current hysteresis) hyS
(Under current set value) uSEt
(Under current set value) uSEt
(Under current hysteresis) hyS
(Over current hysteresis) hyS
(Over current set value) oSEt

NOTE: *Under current protection set value with its hysteresis must not overlap with over current protection set value with its hysteresis or, the under current protection set value must not be higher than the over current protection set value. Otherwise, (LinE ovEr Eror) message will appear on the screen and the output contact will be switched off. In this case you should check the over and the under current set values.*

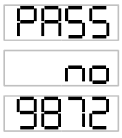
3. Password Inquiry and Menu Entry

3.1 Password Inquiry

If you push the SET button, the password inquiry menu shows up. Using the direction buttons, the authorized operator can increase or decrease the digit value to reach the required value, then pushes SET button to move to the next digit. After inputing the last digit, pushing the SET button approves the password. The " - " on the middle screen makes the digit follow up easier. This way the user knows how many digits he already input.
After the password approval, the user gets "Accepted" or "Rejected" message on the screen for 3 seconds. After that the program main menu shows up, In case of wrong password entry, the user can move through the menu but can not make any changes in the program settings.


Enter
PASS
When the set button is pushed, the password at the buttom screen puts the digit value in the digit division "-" and it slides the digit line to the left digit
It increases or decreases the value of the password

Accepted



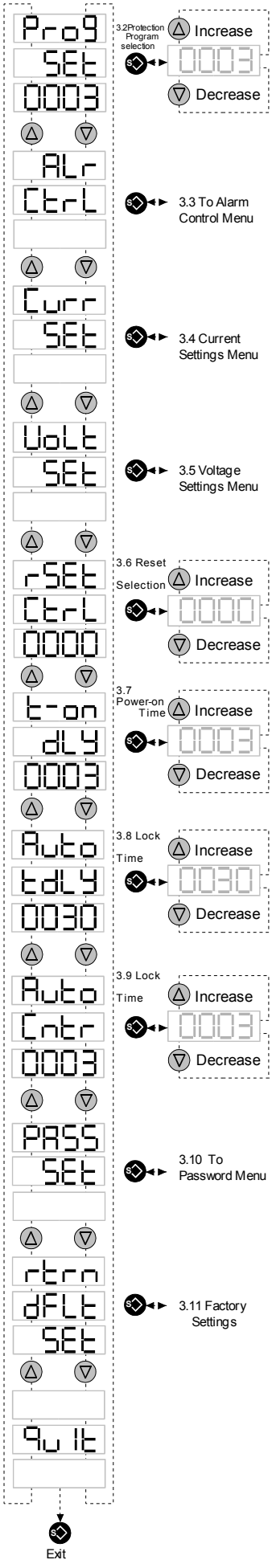
rejected

Pushing the down button shows the menus under the main menu that are in order:protection program selection, alarm control menu, current setting menu, voltage settings menu, reset settings menu, power on timing settings, password menu, failure lock timing settings (in the automatic mode), failue lock counter settings (in the automatic mode), and factory settings.

Viewing Menus:
Because the device is password protected, in case of wrong password entry, the password and the factory settings menus are not shown, the other menus are shown but not changeable. Only correct password entry shows all menus and gives the abilitiy of changing the device settigs.

Buttons Use:
The user can move through the menus using the direction buttons (up – down). When he reaches the required settings he gains access to change the setting by pressing the SET button, the shown value then blinks. Uses the direction buttons to change the values, and pushes the SET button again to store the changes. The blinking values stops blinking then. The user can go to the upper menu seeking the quit command using the direction buttons and then pushing the SET button.

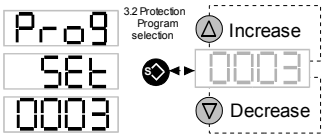
MAIN MENU:



DP-01-96 Digital Protector & Multimeter

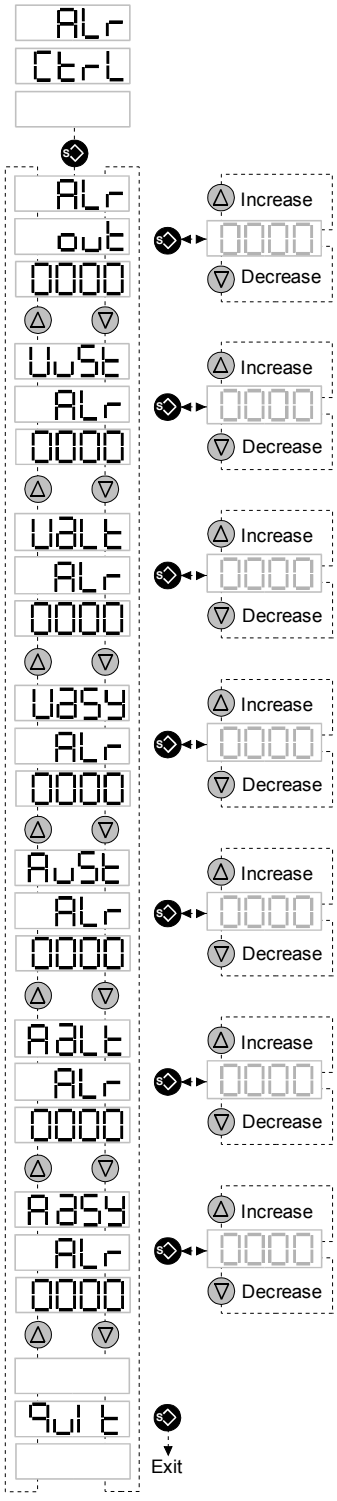
Current & Voltage Protection

3.2 Protection Program Selection



the first menu that comes is the protection program selection.
The Program must be chosen according to the system
- **Prog 1** System protection program, when selected Prg1 led turns on.
(check 1.1.1 section)
- **Prog 2** Motor protection program, when selected Prg2 led turns on.
(check 1.1.2 section)
- **Prog 3** Full protection program, when selected Prg1 and Prg2 leds turn on.
(check 1.1.3 section)

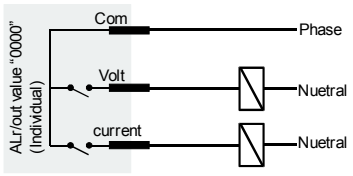
3.3 Alarm Control Menu



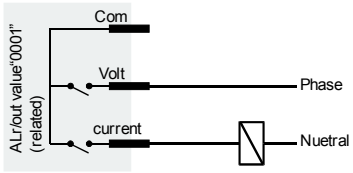
ALr/CtrL :
Alarms can be activated or deactivated in this menu and it is related to the output relay. For example; the occurance of an activated alarm switches off the output relay, with the related alam led blinking. If a deactivated alarm occures, the output relay does not switch off the output relay, only the related alarm led blinks.for this reason the operator must carefully which alarms would be avtivated and which would be deactivated. In automatic mode, when the alarm count reach the limit value within the specified period, the system will be locked and the related alarm led and current or voltage led (maybe both) blink. To know which alarm occurred operator should use the direction buttons to reach the related alarm (current, voltage or maybe both) and observe the failure phase.

Resetting The Alarm:
While functioning in the manual mode, if an alarm occurs (an activated alarm) then the relay switches off the output contact with the related alarm led blinking. To reset the device the operator must push the SET button until the reset led goes off. The thing that must be awared of is that if the opeator releases the set button before the reset button turns off accidently, the main menu entry shows on, the operator has two options then; the first option is to enter the password (no matter the entry is wrong or correct) the use the direction buttons to reach the quit command and press SET button, the second option is to wait for four minutes without pushing any button.If the related alarm led turns off again after a long push of the SET button, it means that the alarm situation is still present.In automatic mode, if the alarm count reaches the limit value within the specified period, the system will be blockedas it does in the manual mode. After fixing the problem, the operator must push the SET button to reset the device.

ALr/out:
It shows the relays' (current and voltage relays) behaviour after passing the alarm situation.



I f the current and voltage output relays are going to be used individually the Alr/out Value should set to “0000”.
The connection way is shown in the Figure next.



If the current and voltage output relays are going to be used together, the Alr/out Value should set to “0001”and the Com terminal must not be used. Unless both of the voltage and current failures fixed the output relays will stay in the switch off mode. The connection way is shown in the figure next.

Uust :
When the over voltage alarm's (Uust) value is (1) it is active, when (0) it is not active. The occurance of an over voltage alarm while Uust is activated switches off the output relay. When Uust is deactivated it does not control the output relay, it only makes the related alarm led blinks.

UaLt :
When the under voltage alarm's (UaLt) value is (1) it is active, when (0) it is not active. The occurance of an under voltage alarm while UaLt is activated switches off the output relay. When UaLt is deactivated it does not control the output relay, it only makes the related alarm led blinks.

UaSy :
When the asymmetric voltage alarm's (UaSy) value is (1) it is active, when (0) it is not active. The occurance of an asymmetric voltage alarm while UaSy is activated switches off the output relay. When UaSy is deactivated it does not control the output relay, it only makes the related alarm led blinks.

Aust :
When the over current alarm's (Aust) value is (1) it is active, when (0) it is not active. The occurance of an over current alarm while Aust is activated switches off the output relay. When Aust is deactivated it does not control the output relay, it only makes the related alarm led blinks.

AaLt :
When the under current alarm's (AaLt) value is (1) it is active, when (0) it is not active. The occurance of an under current alarm while AaLt is activated switches off the output relay. When AaLt is deactivated it does not control the output relay, it only makes the related alarm led blinks.
When Prg1 or Prg2 is selected, the AaLt will not be shpwn on the menu.

AaSy :
When the asymmetric current alarm's (AaSy) value is (1) it is active, when (0) it is not active. The occurance of an asymmetric current alarm while AaSy is activated switches off the output relay. When AaSy is deactivated it does not control the output relay, it only makes the related alarm led blinks.When Prg1 is selected, the AaLt will not be shown on the menu.

qult : To exit the menu.

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3.4 Current Settings Menu:

Curr/SEt : The menu where current settings are made. The operator must push the SET button to enter this menu and can go through the menu using the direction buttons. To change a setting, he must push the SET button, change the vlue using the direction buttons and push the set button again to store the new settings. The nenu's sub parameters are as follows,

Ct : The current transformer ratio. Its value can be input by the operator between 5/5 A and 10000/5 A. It must be entered the same as the system's current transformer ratio.

YOn Lrn: Current transformer polarity direction learning:
(on – oFF)
If it is " on " then the device would learn the direction automatically. If the device monted in new panel or the polarity somehow changed then it learns the new direction. If off then the device would learn the direction once and never learn it again. Off position is required for some loads. I fthere would be a problem in the surrent transformer direction then the current transformer inputs shuld be switched.

oSEt : Over current switch off value. It can be set between Ct x 0.1 and Ct x 1.when the current value exceeds this value the switch off occures after t2 delay time.

uSEt : Under current switch off value.It can be set between Ct x 0.1 and Ct x 1.This option is only avaliable on Pgr3. when the current value goes below this value the switch off occures after t2 delay time.
NOTE: Under current limit must not be set higher or equal to the over current limit . Check section 2.7

hyS : Percentage Hysteresis. It can be set between 0,03 and 0,50. It is used for oSEt and uSEt both.

Cuur/USt: Excessive switch off current multiplier. It can be set between oSEt x 2 and oSEt x 10. When the current value exceeds the adjusted value the switch off occures immediatley without waiting any delay.

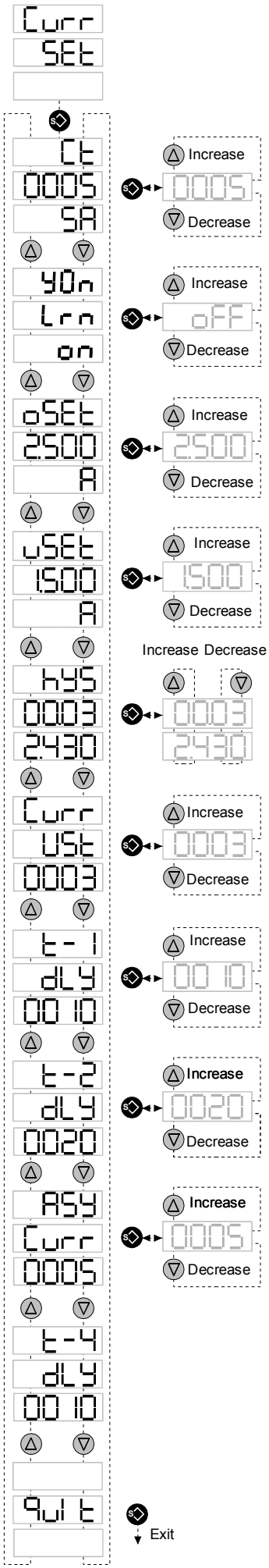
t-1 : Start delay time. It can be set between 1 and 60 seconds.It is not used in Pgr1.
It is used to prevent the switch off from occurance because of the motor's inrush current. Its value will be reset after each time the current goes to zero.
Within this period, the Excessive current multiplier, asymmetric current, over and under voltage are active. Only over and undervoltage alarms are deactivated.

t-2 : Over and under current delay. It can be set between 1 and 30 seconds. After this period the switch off occurs if over or under current alarms occure.

Asy/Curr : Percentage asymmetric current. It can be set between % 5 and % 50. If the unbalance between the phases' current exceeds the adjusted value the switch off occures after t4 delay.

t-4 : asymmetric current delay. It can be set between 1 and 30 seconds. When asymmetric current occures the switch off occures after this period.

qult : To exit the menu.



3.5 Voltage Settings Menu

VoLt/SEt : The menu where voltage settings are made. The operator must push the SET button to enter this menu and can go through the menu using the direction buttons.
To change a setting, he must push the SET button, change the vlue using the direction buttons and push the set button again to store the new settings.The nenu's sub parameters are as follows,

ut/OrAn : The voltage transformer ratio. Its value can be input by the operator between 1 and 1000. If no transformer is avaliable this value must be set to 1.

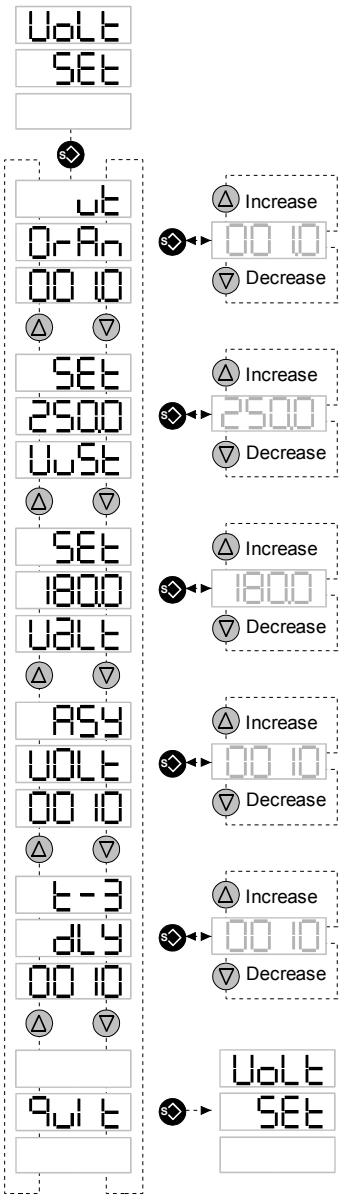
SEt/UuSt : Over voltage switch off value. It can be set between 230V and 270V. This parameter shows the voltage between the phase and the nuetral. If any phase voltage exceeds the ajdusted value the switch off occures after t3 delay.

SEt/UaLt : Under voltage switch off value. It can be set between 170V and 210V. This parameter shows the voltage between the phase and the nuetral. If any phase voltage exceeds the ajdusted value the switch off occures after t3 delay.

ASy/VOLt : Percentage asymmetric voltage. It can be set between % 5 and % 40. If the unbalance between the phases' voltage exceeds the adjusted value the switch off occures after t4 delay.

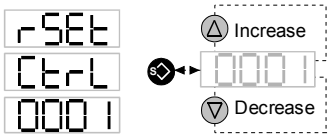
t-3/dLy : Switch off time for voltages. It can be set between 1 and 30 seconds.It is used for both over under under voltage.

qult : To exit the menu.



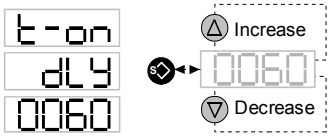
3.6 Reset Settings Menu

rSEt/CtrL : It can be set as 1 or 0.
0: automatik reset
1: manual reset
If **0** is selected, the device resets itself automatically when the failure ends.
If **1** is selected, the reset led tırns off. Even if the failure ends the device will stay in the lock mode until SET is pushed. If the failure continues the device can not be reset. Check section 3.3



3.7 Power-on Delay Menu

t-on/dLy : While Automatic reset is selcted (rSEt/CtrL = 0), it shows the delay time that device will wait to switch on its output relay when failure ends after a switch off
It can be set between 2 and 120 seconds.



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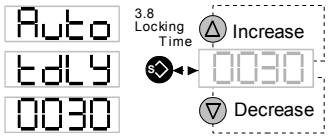
Current & Voltage Protection

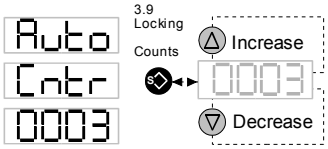
3.8 Locking Period:

Auto/tdLy : While operating in automatic mode, if a failure repeats within a specified period the device will be locked.
To reset and remove the problem SET button must be pushed until the reset led turns off. This option helps the operator to estimate how frequent the alarms occure.This period can be set between 1 and 60 minutes.



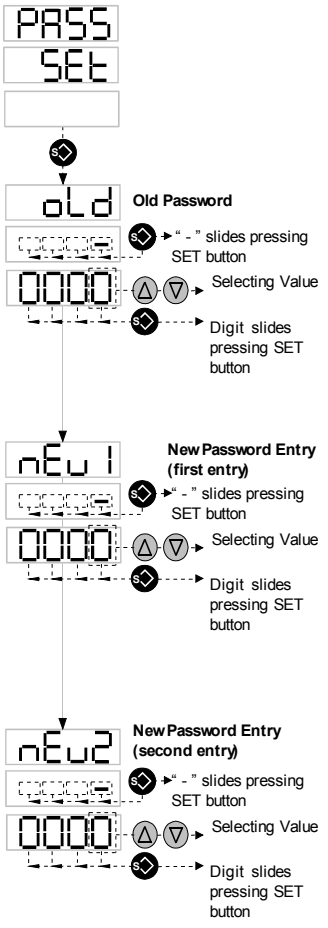
3.9 Locking Counter:

Auto/Cntr : While operating in automatic mode, within the locking period, it shows after how many alarms the device will be locked. To reset and remove the problem SET button must be pushed until the reset led turns off. This option helps the operator to estimate how frequent the alarms occure.It can be set between 2 and 10, or Inf (infinit).



3.10 Password Menu:

If the entry was made by entering the correct password, this menu will show on.
If you want to change the current passowrd push the SET button. Your password will be ask again. Enter you password as it has been explained in section 3.1. After entering your password the device will ask you to enter the new password. After entering the password you will have to confirm the password entiering it again. If your old password is correct and the new password enteries match the message “neu pass yes” will show and the password will be changed. If your old password is wrong or the new password entries do not match the the message “neu pass no” will show and the old password will stay avaliable.

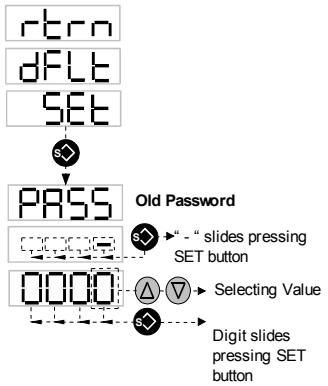


New Password Approved

New Password Rejected

3.11 Factory Settings Menu

To restore the factory setting or to remove any unwanted changes made beofre.
When you reach rtrn dFLt SET if you press SET button the device will ask for your password.
If the password entry is correct the device will reset its memory and restore the factory settings with the message “ rtrn dFLt yES “ showing on the screen for 3 seconds.
In case of wrong entry the factory settings will not be restored and the message “ rtrn dFLt no “ message will appear on the screen for 3 seconds.



Password approved
Factory setting are restored

Password Rejected
The old setting lasts

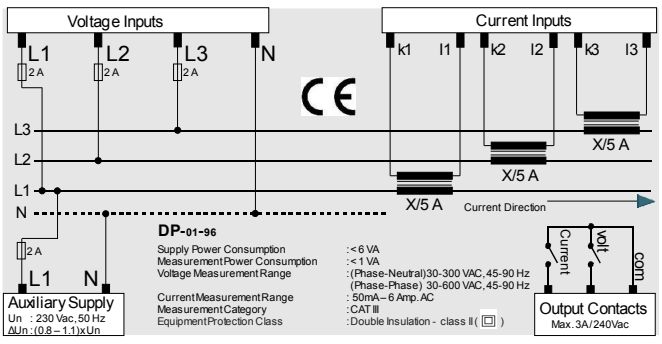
The Factory Settings that are stored in the device's memory are given below;

Ct (Current transformer ratio)	: 5/5 A
oSEt (Over current set value)	: 4 A
uSEt (Under current set value)	: 2 A
hyS (hysteresis)	: % 10
Cuur/USt (Sudden switch off multiplier)	: (oSEt) x 3
t-1 (Start delay time)	: 20 sn
t-2 (Over-under current delay)	: 5 sn
Asy/Cuur (Asymmetric current)	: % 25
t-4 (Asymmetric current alarm delay)	: 2 sn
Set/UuSt (Over voltage set value)	: 240 V
Set/UaLt (Under Voltage set value)	: 195 V
Asy/VOLt (Asymmetric voltage)	: % 15
t-3 (Voltage alarms delay)	: 5 sn
Protection Program	: Prog 3 (full protection)
rSEt/CtrL (reset selection)	: 0 (automatic reset)
t-on (power-on time)	: 5 seconds
Auto/tdLy (Locking Period)	: 10 minutes
Auto/Cntr (Locking counter)	: 5 times
Alarms	: All active
ALr/out value	:“0000” Individual relays

TECHNICAL INFORMATIONS

Rated Voltage (Un)	: 220Vac
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 Hz
Supply Power Consumption	: < 8VA
Measurement Inputs	
Power Consumption	: < 1VA
Voltage Measurement Range	: (Phase-Neutral) 30 - 300 Vac, 45-90 Hz
	: (Phase-Phase) 30 - 600 Vac, 45-90 Hz
Current Measurement Range	: (for seconder current) 50 mA - 6 Amp AC
Display Ranges	: 0 - 999,9 kV
	: 0 - 999,9 M (W)
	: (CosΦ) 0,00 -1,00 ind. and kac.
Mimimum Measurement Values	: 50 mA , 25 V
Measurement Sensitivity	: %1±1 digit
Gerilim Trafosu Oranı	: 1 1000
Akım Trafosu Oranı	: 5/5.....10000/5 A
Display	: 4 Digit LED display
Relay Contact Current	: max. 3A / 240Vac
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Operating Temperature	: - 5 °C .... + 50 °C
Operating Humidity	: %15 ..... %95 (without condensation)
Connection Type	: To the Front Panel Tap
Dimensions	: 96 x 96 x 80 mm

Connection :



DAM – A - 72

DIGITAL UNIVERSAL AMPERMETER (True RMS)

► With Demand

General Informations

The device can be used in electrical panels, laboratories and test devices. With the assistance of a current transformer, it measures the AC current passing through the system in terms of Amper unite. After energizing the device, "dA -A " message appears on it's screen for 2 seconds and then it starts to show the current value

■ The current transformer ratio can be adjusted between 5/5 and 10000/5 using the touch buttons on the front panel of the device.

■ Stores the maximum demand value and the peak value on its memory and keeps these values even if the energy supply goes off.

■ When the measured value of the seconder current reaches 5,1 A, " OvEr" message starts to flash on the screen to warn the user that the value of the current exceeded the limit values.

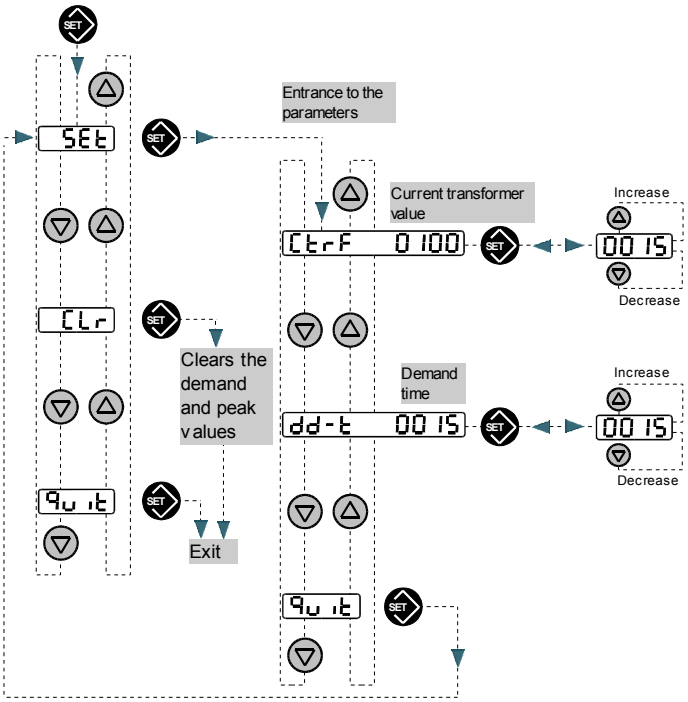
Button Functions:

Using the direction buttons, it is possible to go through the nemu up and down. "SEt" message will appear on the screen if the set button pressed. To set one of the parameters set button must be pressed again inorder to enter that menu. The first parameter that can be set in the set menu is transformer's primer current value, that would flash on the screen with the message " CtrF" while setting. Pressing the set button and the direction buttons can increase and decrease this value " between 5 and 10000". after reaching the required value set button should be pressed to store this value on the device. After that pressing the down button leads to the demand time setting with dd-t flashing on the screen.

To make an adjustment, set button must be pushed. With the direction buttons the value can be adjusted "between 10 and 60 minutes". After reaching the required value pressing set button would store this value. Next what would appear in the SEt menu pressing the down direction button is qUit. Pressing the set button would exit the set menu.

The next menu after set menu is Clr, " can be reached by pressing down button". To clear the maximum demand and the peak value set button must be pressed. After the Clr menu qUit show appear. Pressing set there would return the screen to the measurement screen.

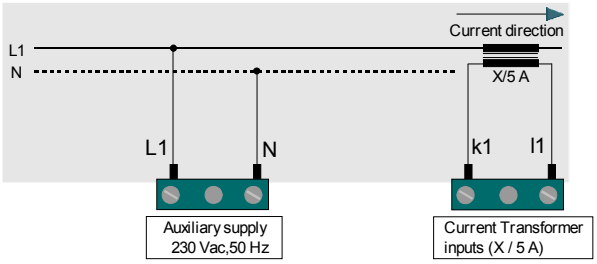
While in measurement screen, pressing the up direction button shows the maximum peak current value occurred since the last operation done, pressing the down direction button shows the maximum demand occurred since last Clr operation done.



Technical Data

Operational Voltage (Un): 220Vac
Operating range : (0,8-1,1) x Un
Frequency : 50 Hz
Power Consumption : < 4VA
Measurement Sensitivity : %1 +1 digit
Current Transformer
Ratio : 5/5.....10000/5 A
Display : 4 Digits Led Display
Protection Class : IP 20
Terminal Protection Class: IP 00
Operation Temperature: - 5 °C .... + 50 °C
Operation Humidity : %15 ..... %95
(without consensation)
Installation : to the panel tap
Dimensions : DA – A – 96 (96x96x80 mm)
: DA – A – 72 (72x72x80 mm)

Connection Scheme:



Warning !!!

- The message Err1 or Err2 on the screen means that the device has got a failure
- Can not be used without current transformer, a current that is higher that 5 A passing through the measurement inputs may damage the device.
- To clean the device use dry dustcloth after de-energizing the device

DAM – B - 72

DIGITAL UNIVERSAL AMPERMETER (True RMS)

- ► With Demand
- ► Over Current Adjustment

General Informations

The device can be used in electrical panels, laboratories and test devices. With the assistance of a current transformer, it measures the AC current passing through the system in terms of Amper unite. If the current exceeds the adjusted current then then alarm led starts to blink and after the the adjusted time delay it changes the outputs possition.

When the current exceeds the adjusted over current value the device starts to count for the adjusted delay time and after that it opens its output contacts.

After energizing the device, "dA -b " message appears on it's screen for 2 seconds and then it starts to show the current value.

■ The current transformer ratio can be adjusted between 5/5 and 10000/5 using the touch buttons on the front panel of the device.

■ Stores the maximum demand value and the peak value on its memory and keeps these values even if the energy supply goes off.

■ When the measured value of the seconder current reaches 5,1 A, " OvEr" message starts to flash on the screen to warn the user that the value of the current exceeded the limit values.

Fast Buttons:

While in measurement screen, pressing up button shows the peak value △

Pressing down button shows the maximum demand value ▽

Main Menu :

Pressing on the set button leads to the main menu. The menu contains **OP**, **CLr**, **SEt** and **qult** in order.

► **OP:** Shows the opening counter " that occures when the adjusted over current values being exceeded.

► **Clr:** Peak and maximum demand values can be cleared in this menu. To enter this menu, set button must be pressed. **cALL**, **c-OP**, **c-dp** and **qult** submenus are included within this menu.

- ► **cALL :** It is used to clear all peak, maximum demand and opening counter values by pressing the set button.
- ► **c-OP :** It is used only to clear the opening counter value.
- ► **c-dp :** It is used only to clear the peak and the maximum demand values.
- ► **qult :** To exit the submenus and return back to the main menu.

► **Set :** The menu that parameters can be adjusted in. to enter this menu set button must be pressed. **ctrF**, **SP**, **hYS**, **d-t**, **Sd-t**, **r-t**, **dd-t**, **CO**, **LtCh**, **tP**, and **qult** submenus are included within this menu. These parameters will flash on the screen. In order to change any of them set button must be pressed, then the screen will stop flashing and using the direction buttons the new value can be applied. Pressing the set button again would store this value.

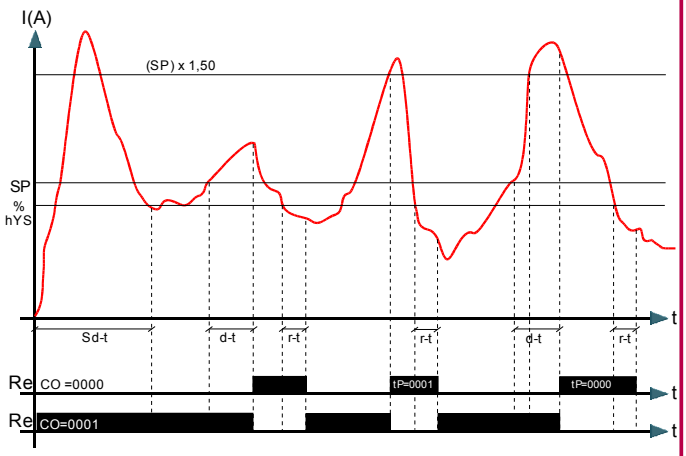
- ► **ctrF :** **Current transformer ratio.** It can be set between 5 and 10000. Inorder to set the value, set button must be pressed then using the direction button the aimed value can be set. Pressing set again would store the new value.
- ► **SP :** **Over current value set menu.** It can be set between the maximum current allowed for the current transformer and %10 of the that value. For example for 500/5A transformer, it can be set between 50 and 500A.
- ► **hYS :** **The percentage Hysteresis value.** It can be adjusted between 0,03 and 0,50. When the current exceeds the adjusted over current value then an opening occures. In order to close the output contact again, the current must go below the adjusted over current value multiplied by the %hYS, otherwise it will keep the output open.
- ► **d-t :** **Delay time.** It can be adjusted between 1 and 30 seconds. The opening of current exceeding adjusted current limit occures after this delay.
- ► **Sd-t :** Start delay time. It can be set btween 0 and 60 seconds. It is used to prevent any unwanted opening while current is starting from 0 " especially for motors that need high current for start up". In this period opening wouldn't occure even if the current exceeds the adjusted over current value. If this value is set to "0000" the the device will wait for the delay time d-t and then opens its output.
- ► **r-t :** **Return time.** The time required to turn back from an alarm situation. The device waits for that period after the current returns below the adjusted value. It can be set between 2 and 10 seconds.
- ► **dd-t :** **Demand time.** The time required to return back from an alarm. The device waits for that period after the current returns below the adjusted over current limit value. It can be set between 2 and 10 seconds.
- ► **CO :** The menu to adjust the output contact possition.
  - ■ if the value is set to 0000 then the output in normal situation is closed contact and is alarm situation is open contact.
  - ■ if the value is set to 0001 then the output in normal situation is open contact and is alarm situation is closed contact.
- ► **LtCh :** **Latch function.** The place to choose wether the device will go out of an alarm manually or automatically
  - ■ if the value is set to 0000 then the latch function is off and the device will go out of the alarm automatically
  - ■ if the value is set to 0001 then the latch function is on and the device wouldn't go out of the alarm unless the user presses the set button until the alarm led turns off. If pressed, then device then will go out of the alarm after the delay time r-t.
- ► **tP :** Sudden opening function. If the current goes over %150 of the adjusted over current value the the device will open its output without any delay.
  - ■ if 0000 then the function is disabled .
  - ■ if 0001 then the function is enabled.

  (not active while start delay time (Sd-t)).
- ► **quit :** Pressing set leads to the main menu.

► **quit :** Pressing set leads to the measurement screen.

Button Functions :

To enter the menu set button must be pressed. Within the menu, the parameters can e reached using the direction buttons. To inter the desired menu set button must be pushed again. This parameters can be adjusted using the direction buttons, pressing the set button again stores the new parameters.



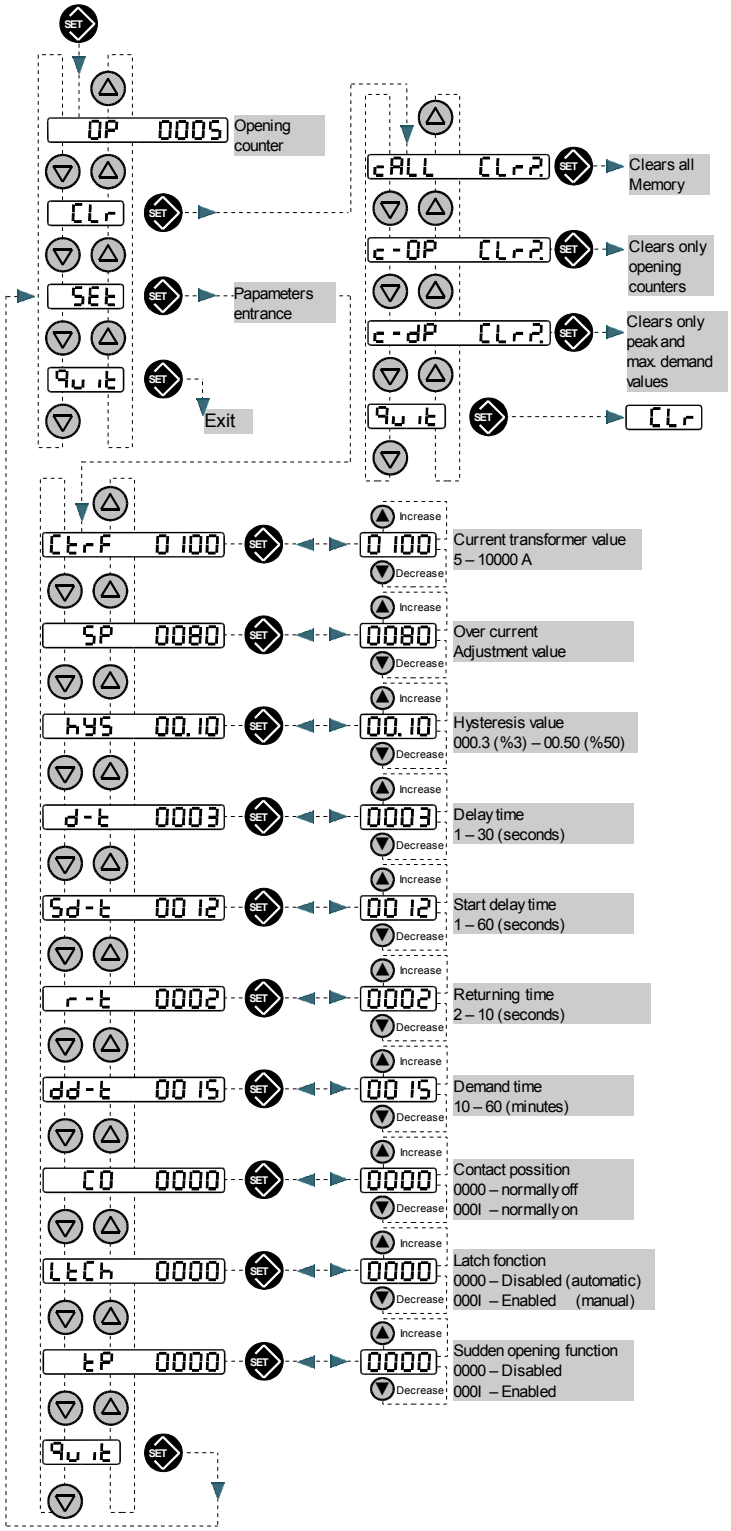
Technical Data

Operational Voltage (Un)	: 220Vac
Operating range	: (0,8-1,1) x Un
Frequency	: 50 Hz
Power Consumption	: < 4VA
Measurement Sensitivity	: %1 +1 digit
Current Transformer Ratio	: 5/5.....10000/5 A
Display	: 4 Digits Led Display
Contact Current	: Max. 3A / 240Vac
Protection Class	: IP 20
Terminal Protection Class	: IP 00
Operating Temperature	: - 5 °C .... + 50 °C
Operating Humidity	: %15 ..... %95 (without condensation)
Installation	: to the panel tap
Dimentions	: 72x72x80 mm

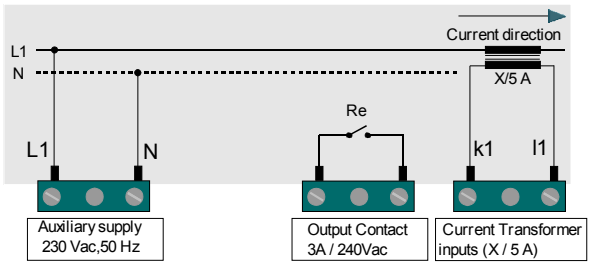
DAM – B - 72

DIGITAL UNIVERSAL AMPERMETER (True RMS)

- ► With Demand
- ► Over Current Adjustment



Connection Scheme:



Warning !!!

- The message Err1 or Err2 on the screen means that the device has got a failure
- Can not be used without current transformer, a current that is higher that 5 A passing through the measurement inputs may damage the device.
- To clean the device use dry dustcloth after de-energizing the device

DAM – C - 72

DIGITAL UNIVERSAL AMPERMETER (True RMS)

► With Demand
► Over & Under Current Adjustment

General Informations

The device can be used in electrical panels, laboratories and test devices. With the assistance of a current transformer, it measures the AC current passing through the system in terms of Amper unite. When the current exceeds the adjusted over current or goes below the adjusted under current values the device starts to count for the adjusted delay time and after that it changes Re1 or Re2 outputs contact possition. After energizing the device, "dA -c " message appears on it's screen for 2 seconds and then it starts to show the current value.

■ The current transformer ratio can be adjusted between 5/5 and 10000/5 using the touch buttons on the front panel of the device.

■ Stores the maximum demand value and the peak value on its memory and keeps these values even if the energy supply goes off.

■ When the measured value of the seconder current reaches 5,1 A, " OvEr" message starts to flash on the screen to warn the user that the value of the current exceeded the limit values

Fast Buttons:

While in measurement screen, pressing up button shows the peak value

Pressing down button shows the maximum demand value

Main Menu :

Pressing on the set button leads to the main menu. The menu contains **o-OP**, **u-OP**, **CLr**, **SEt** and **qult** in order.

► **OP :** Shows the opening counter " that occures when the adjusted over current values being exceeded

► **CLr :** Peak and maximum demand values can be cleared in this menu. To enter this menu, set button must be pressed. **cALL**, **c-OP**, **c-dp** and **qult** submenus are included within this menu.

- ► **cALL :** It is used to clear all peak, maximum demand and opening counter values by pressing the set button.
- ► **c-OP :** It is used only to clear the opening counter value.
- ► **c-dp :** It is used only to clear the peak and the maximum demand values.
- ► **qult :** To exit the submenus and return back to the main menu.

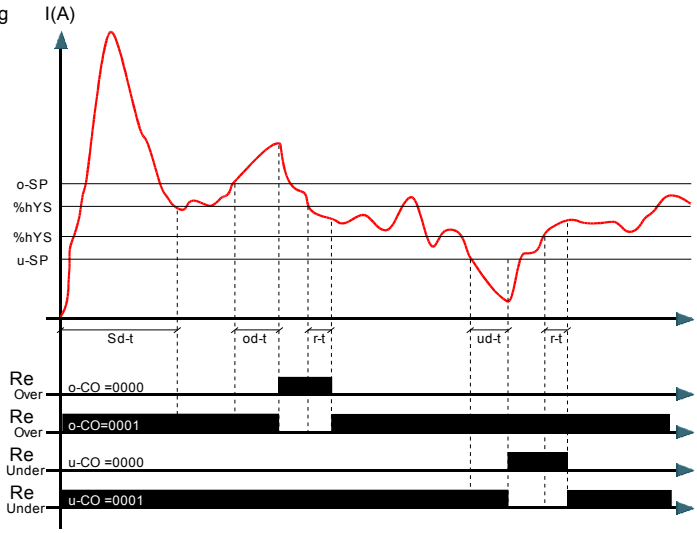
► **Set :** The menu that parameters can be adjusted in. to enter this menu set button must be pressed. **CtrF**, **o-SP**, **u-SP**, **hYS**, **od-t**, **ud-t**, **Sd-t**, **r-t**, **dd-t**, **o-CO**, **u-CO**, **LtCh**, **tP**, and **qult** submenus are included within this menu. These parameters will flash on the screen. In order to change any of them set button must be pressed, then the screen will stop flashing and using the direction buttons the new value can be applied. Pressing the set button again would store this value.

- ► **ctrF : Current transformer ratio.** It can be set between 5 and 10000. In order to set the value, set button must be pressed then using the direction button the aimed value can be set. Pressing set again would store the new value.
- ► **o-SP : Over current value set menu.** It can be set between the maximum current allowed for the current transformer and %10 of the that value. For example for 500/5A transformer, it can be set between 50 and 500A.
- ► **u-SP : Under current value set menu.** It can be set between the maximum current allowed for the current transformer and %10 of the that value.
- ► **hYS : The percentage Hysteresis value.** It can be adjusted between 0,03 and 0,50. When the current exceeds the adjusted over current value then an opening occures. Inorder to close the output contact again, the current must go below the adjusted over current value multiplied by the %hYS, otherwise it will keep the output open.
- ► **od-t : Delay time for over current alarm.** It can be adjusted between 1 and 30 seconds. The opening of current exceeding adjusted current limit occures after this delay.
- ► **ud-t : Delay time for under current alarm.** It can be adjusted between 1 and 30 seconds. The opening of current exceeding adjusted current limit occures after this delay.
- ► **Sd-t : Start delay time.** It can be set btween 0 and 60 seconds. It is used to prevent any unwanted opening while current is starting from 0 " especially for motors that need high current for start up". In this period opening wouldn't occure even if the current exceeds the adjusted over current value. If this value is set to "0000" the device will wait for the delay time d-t and then opens its output.
- ► **r-t : Return time.** The time required to turn back from an alarm situation. The device waits for that period after the current returns below the adjusted value. It can be set between 2 and 10 seconds.
- ► **dd-t : Demand time.** The time required to return back from an alarm. The device waits for that period after the current returns below the adjusted over current limit value. It can be set between 2 and 10 seconds.
- ► **o-CO :** The menu to adjust the over current output contact possition.
  - ■ if the value is set to 0000 then the output in normal situation is closed contact and in over current alarm situation is open contact.
  - ■ if the value is set to 0001 then the output in normal situation is open contact and in over current alarm situation is closed contact.
- ► **u-CO :** The menu to adjust the under current output contact possition.
  - ■ if the value is set to 0000 then the output in normal situation is closed contact and in under current alarm situation is open contact.
  - ■ if the value is set to 0001 then the output in normal situation is open contact and in over current alarm situation is closed contact.
- ► **LtCh : Latch function.** The place to choose wether the device will go out of an alarm manually or automatically
  - ■ if the value is set to 0000 then the latch function is off and the device will go out of the alarm automatically
  - ■ if the value is set to 0001 then the latch function is on and the device wouldn't go out of the alarm unless the user presses the set button until the alarm led turns off. If pressed, then device then will go out of the alarm after the delay time r-t.
- ► **tP :** Sudden opening function. If the current goes over %150 of the adjusted over current value the the device will open its output without any delay.
  - ■ if 0000 then the function is disabled .
  - ■ if 0001 then the function is enabled. (not active while start delay time (Sd-t)).
- ► **quit :** Pressing set leads to the main menu.

► **quit :** Pressing set leads to the measurement screen.

Button Functions :

To enter the menu set button must be pressed. Within the menu, the parameters can e reached using the direction buttons. To inter the desired menu set button must be pushed again. This parameters can be adjusted using the direction buttons, pressing the set button again stores the new parameters.



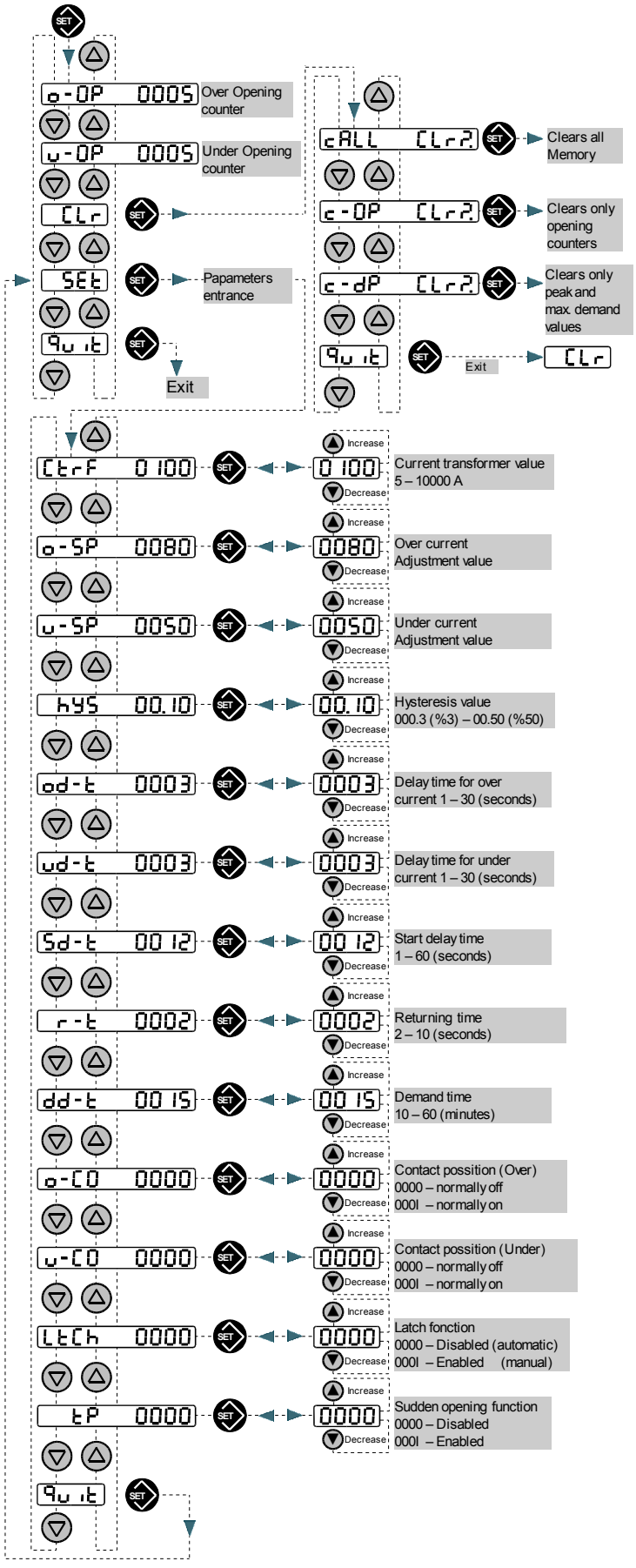
Technical Data

Operational Voltage (Un)	: 220Vac
Operating range	: (0,8-1,1) xUn
Frequency	: 50 Hz
Power Consumption	: < 4VA
Measurement Sensitivity	: %1 +1 digit
Current Transformer Ratio	: 5/5.....10000/5 A
Display	: 4 Digits Led Display
Contact Current	: Max 3A / 240Vac
Protection Class	: IP 20
Terminal Protection Class	: IP 00
Operating Temperature	: - 5 °C .... + 50 °C
Operating Humidity	: %15 ..... %95 (without condensation)
Installation	: to the panel tap
Dimentions	: 72x72x80 mm

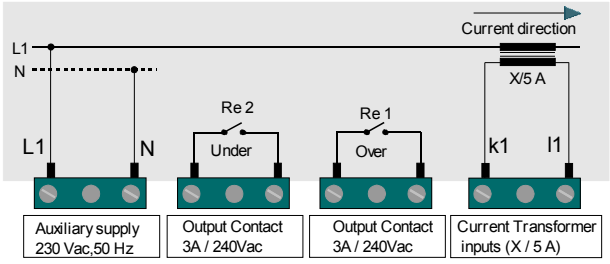
DAM – C - 72

DIGITAL UNIVERSAL AMPERMETER (True RMS)

- ► With Demand
- ► Over & Under Current Adjustment



Connection Scheme:



Warning !

- The message Err1 or Err2 on the screen means that the device has got a failure
- Can not be used without current transformer, a current that is higher that 5 A passing through the measurement inputs may damage the device.
- Clean the device using dry dustcloth after de-energizing the device
- o-SP and u-SP must be set as shown in the graphic below without having any intersection , otherwise Eror message will show on the screen.

DAM – D - 72

DIGITAL UNIVERSAL AMPERMETER (True RMS)

► 2 Over Current Set

General Informations

The device can be used in electrical panels, laboratories and test devices. With the assistance of a current transformer, it measures the AC current passing through the system in terms of Amper unite. Two over current set (SP1, SP2) with a different output contact for each.The first set value is SP2, the higher one is SP1. When the current exceeds the adjusted first over current value (SP2) then the alarm1 led will start to blink and after the set delay time, the device would change the possition of the Re2 output contact.

If the current exceeds the higher over current value the device opens its 1st output too. The current is called normal if it is below these two limits. After energizing the device, "dA -d " message appears on it's screen for 2 seconds and then it starts to show the current value.Even when the power supply is off, the stored values will not be deleted.

■ When the measured value of the seconder current reaches 5,1 A, " OvEr" message starts to flash on the screen to warn the user that the value of the current exceeded the limit values.

Fast Buttons:

While in measurement screen, pressing up button shows SP1

Pressing down button shows SP2

Parameter entrance :

It can be reached pressing the set button.

Set : The menu that parameters can be adjusted in. to enter this menu set button must be pressed. **CtrF**, **SP1**,**d-t1**, **SP2**, **d-t2**, **hYS**, **Sd-t**, **r-t**, **CO**, **LtCh**, **cut**, and **quit** submenusare included within this menu. These parameters will flash on the screen. In order to change any of them set button must be pressed, then the screen will stop flashing and using the direction buttons the new value can be applied. Pressing the set button again would store this value.

► **ctrF : Current transformer ratio.** It can be set between 5 and 10000. Inorder to set the value, set button must be pressed then using the direction button the aimed value can be set. Pressing set again would store the new value.

► **SP1 : Higher over current value set menu.** It can be set between the maximum current allowed for the current transformer and %10 of the that value. For example for 500/5A transformer, it can be set between 50 and 500A.

► **d-t1 : Delay time for the higher over current alarm(SP1).** It can be adjusted between 1 and 30 seconds. The opening of current exceeding adjusted current limit occures after **d-t1** delay.

► **SP2 : First over current value set menu.** It can be set between the maximum current allowed for the current transformer and %10 of the that value. For example for 500/5A transformer, it can be set between 50 and 500A.

► **d-t2 : Delay time for the first over current alarm(SP1).** It can be adjusted between 1 and 30 seconds. The opening of current exceeding adjusted current limit occures after **d-t2** delay.

► **hYS : The percentage Hysteresis value.** It can be adjusted between 0,03 and 0,50. When the current exceeds the adjusted over current value then an opening occures. Inorder to close the output contact again, the current must go below the adjusted over current value multiplied by the %hYS, otherwise it will keep the output open.

► **Sd-t : Start delay time.** It can be set btween 0 and 60 seconds. It is used to prevent any unwanted opening while current is starting from 0 " especially for motors that need high current for start up". In this period opening wouldn't occure even if the current exceeds the adjusted over current value.

If this value is set to "0000" the the device will wait for the delay time **d-t1** and then opens its output.

► **r-t : Return time.** The time required to turn back from an alarm situation. The device waits for that period after the current returns below the adjusted value. It can be set between 2 and 10 seconds.

► **CO : The menu to adjust the output contact possition.**

■ if the value is set to 0000 then the output in normal situation is closed contact and is alarm situation is open contact.

■ if the value is set to 0001 then the output in normal situation is open contact and is alarm situation is closed contact.

► **LtCh : Latch function.** The place to choose wether the device will go out of an alarm manually or automatically

■ if the value is set to 0000 then the latch function is off and the device will go out of the alarm automatically

■ if the value is set to 0001 then the latch function is on and the device wouldn't go out of the alarm unless the user presses the set button until the alarm led turns off. If pressed, then device then will go out of the alarm after the delay time r-t.

► **cut : Sudden opening function**. If the current goes over %150 of the adjusted over current value the the device will open its output without any delay.

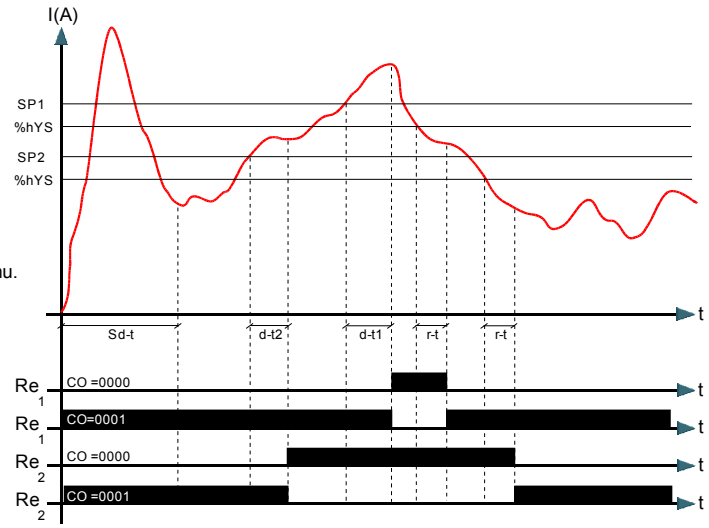
■ if 0000 then the function is disabled .

■ if 0001 then the function is enabled. (not active while start delay time (Sd-t)).

► **quit :** Pressing set leads to the measurement screen.

Button Functions :

To enter the menu set button must be pressed. Within the menu, the parameters can e reached using the direction buttons. To inter the desired menu set button must be pushed again. This parameters can be adjusted using the direction buttons, pressing the set button again stores the new parameters.



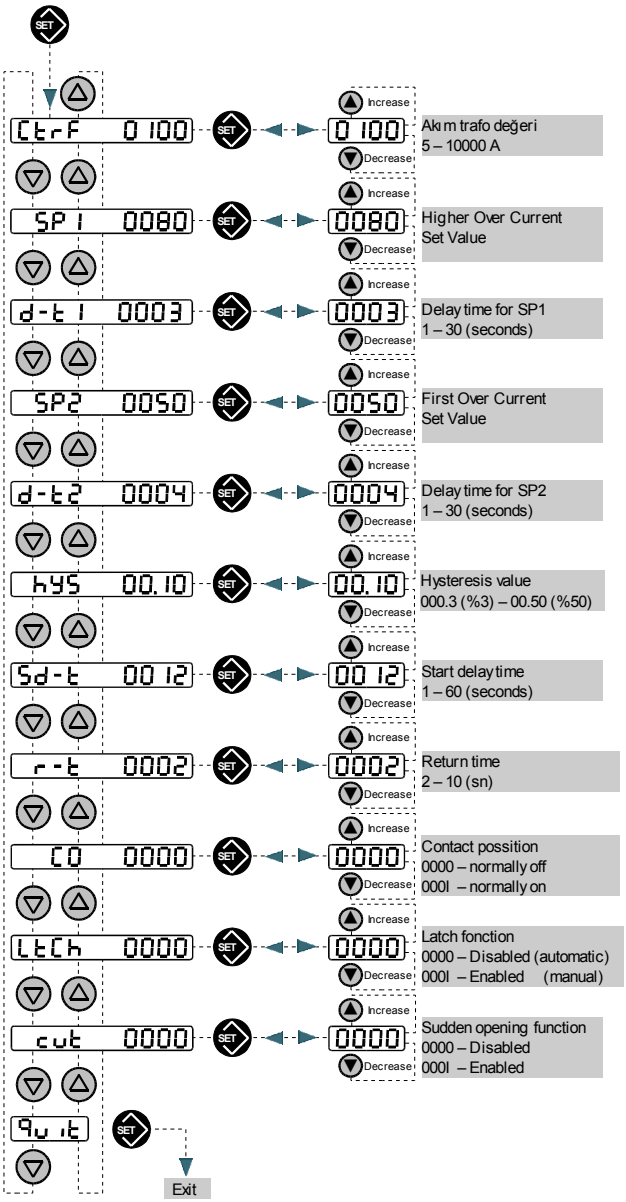
Technical Data

Operational Voltage (Un)	: 220Vac
Operating range	: (0,8-1,1) x Un
Frequency	: 50 Hz
Power Consumption	: < 4VA
Measurement Sensitivity	: %1 +1 digit
Current Transformer Ratio	: 5/5.....10000/5 A
Display	: 4 Digits Led Display
Contact Current	: Max. 3A / 240Vac
Protection Class	: IP 20
Terminal Protection Class	: IP 00
Operating Temperature	: - 5 °C .... + 50 °C
Operating Humidity	: %15 ..... %95 (without condensation)
Installation	: to the panel tap
Dimentions	: 72x72x80 mm

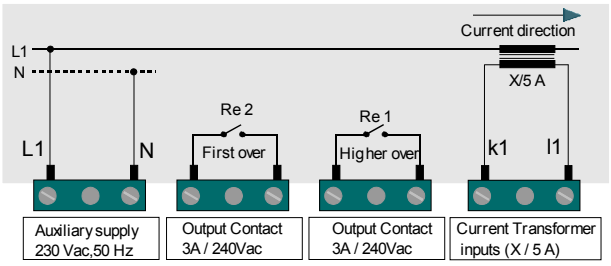
DAM – D - 72

DIGITAL UNIVERSAL AMPERMETER (True RMS)

► 2 Over Current Set



Connection Scheme:



Warning !!!

- The message Err1 or Err2 on the screen means that the device has got a failure
- Can not be used without current transformer, a current that is higher that 5 A passing through the measurement inputs may damage the device.
- To clean the device use dry dustcloth after de-energizing the device

DV – 72 - 01

DIGITAL VOLTMETER & FREQUENCYMETER

► True RMS

General Informations

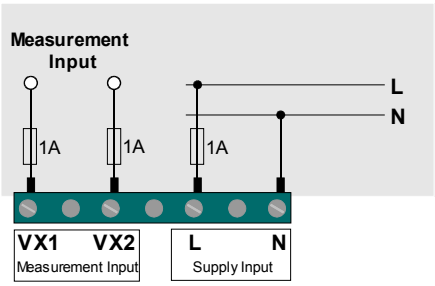
The device measures the RMS value of the AC voltage and the frequency. It shows the voltage on the upper display and the frequency value on the buttom display simultaneously.
Voltage can be measured within the range of 10-500 V.
Frequency can be measured with in the range of 40-100 Hz

Installation Instructions:

- Read the user instructions and cautions before installation.
- Be sure that the panel you are installing in is not energized.
- The device is designed to be installed to the front panel tap, use the small fixing apparatus to stabilize the device to the front panel tap.
- Do not under any case open the front panel of the device.
- Open the Terminals at the back side of the device after you are sure that no energy is connected to the panel. Connect the device as shown in the connection scheme.
- Be sure that the terminals are connected tight to the device.
- Use a switch between the energy network and the device's supply and measurement inputs in order to switch off the device if required. Use 1A FF fuse between switchs and all inputs.

DV-72-01

Connection Scheme :



Technical Data

Rated Voltage (Un)	: 220 VAC
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 Hz
Supply Power Consumption	: < 4 VA
Measurement input	: 10 – 500 Vac
Measurement Frequency	: 40 / 100 Hz
Measurement Power Consumption	: <1VA
Measurement Sensitivity	: 1% ± digit
Display	: Two lines of 3 Digits LED display
Device Protection Class	: IP20
Connector Protection Class	: IP00
Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 72x72x80 mm

Dimensions For Hole On The Panel : 68 x 68 mm

Warning !!!

- The message Er1 or Er2 on the screen means that the device has got a failure
- Clean the device using dry dustcloth after de-energizing the device
- Please read and follow the instructions mentioned in this user manual.

DV – 72 - 03

DIGITAL TRIPHASE VOLTMETER & FREQUENCYMETER

► True RMS

General Informations

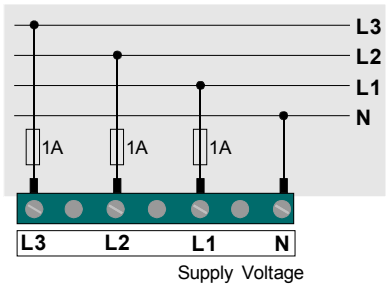
In triphase systems, the device measures the RMS value of the AC voltage and the frequency. It shows the voltage on the upper display and the frequency value on the buttom display simultaneously.
Using the button on the device phase – neutral and phase – phase voltage scan be seen.
Voltage can be measured within the range of 10-500 V.
NOTE : L1_N is the device's supply input. For that reason the voltage applied to L1 _N should be the rated voltage in the system. Frquency measurement must be within the rate frquency ranges.

Installation Instructions:

- Read the user instructions and cautions before installation.
- Be sure that the panel you are installing in is not energized.
- The device is designed to be installed to the front panel tap, use the small fixing apparatus to stabilize the device to the front panel tap.
- Do not under any case open the front panel of the device.
- Open the Terminals at the back side of the device after you are sure that no energy is connected to the panel. Connect the device as shown in the connection scheme.
- Be sure that the terminals are connected tight to the device.
- Use a switch between the energy network and the device's supply and measurement inputs in order to switch off the device if required. Use 1A FF fuse between switchs and all inputs.

DV-72-03

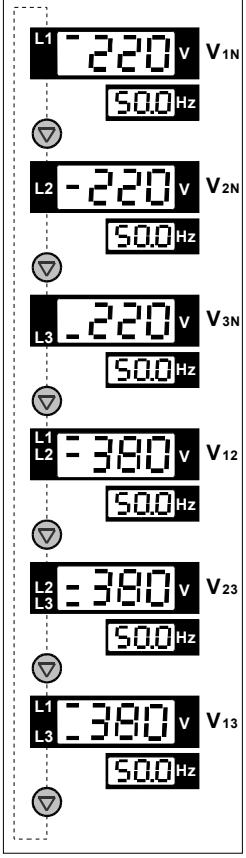
Connection Scheme :



Technical Data

Rated Voltage (Un)	: 220 VAC (L1-N)
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4 VA
Measurement input	: 10 – 500 Vac
Measurement Frequency	: 40 / 100 Hz
Measurement Power Consumption	: <1VA (for each phase)
Measurement Sensitivity	: 1% ± digit
Display	: Two lines of 3 Digits LED display
Device Protection Class	: IP20
Connector Protection Class	: IP00
Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 72x72x80 mm

Display Functions



Dimensions For Hole On The Panel : 68 x 68 mm

Warning !!!

- The message Er1 or Er2 on the screen means that the device has got a failure
- Clean the device using dry dustcloth after de-energizing the device
- Please read and follow the instructions mentioned in this user manual.

DV – 72 - 01C

DIGITAL VOLTAGE & FREQUENCY MONITORING DEVICE

► True RMS

General Informations

The device measures the True RMS value of the voltage and frequency in mono phase systems accurately.
It is possible to observe the voltage value in the upper screen and the frequency value in the buttom screen simultaneously.
The device contains many protections as followes:

- Over Voltage protection.
- Under voltage protection:
- Over frequency protection.
- Under frequency protection.

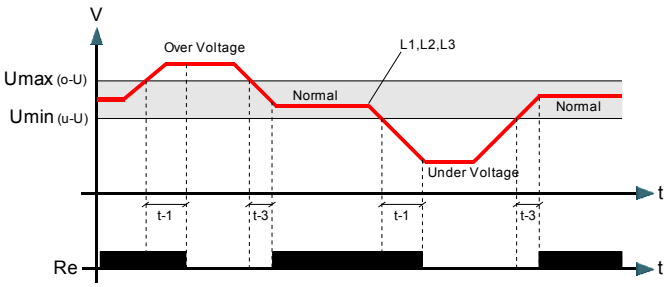
As the device is beeing installed it closes its output contact if the voltage and frequency values are within the adjusted ranges. In case of any previous mentioned faults the the device opens its output contact at the end ofdelay adjusted by user. When the values return withiin the adjusted ranges the device closes its output contacts at the end of an adjusted delay.

Over&Under Voltage : (o-U) (u-U)

Over voltage (o-U), it can ve adjusted between Umax= (230 – 290 V).
Under voltage (u-U), it can ve adjusted between Umin=(150 – 210 V).

- If the voltage drops below the adjusted under voltage limit then **u-U** shows on the screen and the device closes it output contact after t-1 delay.
- If the voltage excceds the adjusted over voltage limit then **o-U** shows on the screen and the device closes it output contact after t-1 delay.

The hysteresis value is 6V.



Locking Property :

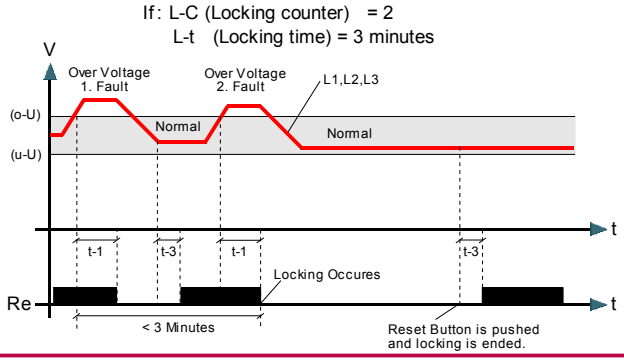
It can be controlled by two parameters; Locking Time and Locking Counter.
If the number of openning reaches the adjusted locking counter within the adjusted locking time then the device opens its output contact and locks its functions until the user pressed **Reset** button. If the locking counter is adjusted to **oto** then this function is inactive and the device never locks itself

L-t : Locking Time (001 – 060 minutes)

It is well known the the frequentely occuring faults may damage the system. For that the device locks itself when the number of faults reaches the adjusted locking number within this locking time. This way the sistem is protected and the user has the chance to investigate the problem.

L-C : Locking Counter (oto , 001 – 010)

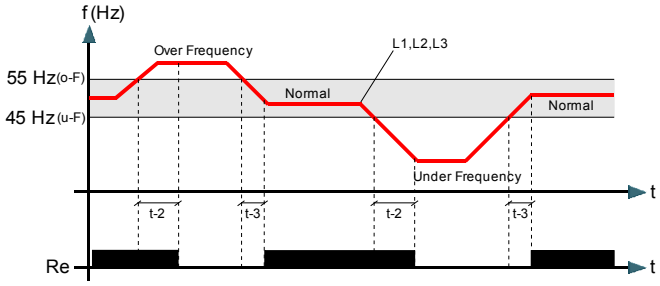
The number of the faults allowed within the period L-t. If the number of the faults exceeds this adjusted counter value then the device locks itself. The user must press Reset button agter the fault passes in order to unlock the device. If L-C is set to **oto** then this property is inactive.



Over and/or Under Frequency Protection : (40 – 70 Hz)

Under frequency can be adjusted be tween (u-F) = 40 Hz .....[(o-F)-0,4]
Over frequency can be adjusted between (o-F) = [(u-F) + 0,4]..... 70 Hz.
It is possible to activate one or two of these protections or deactivate them both.

- If o-F = 55 Hz and u-F = oFF then the device protects from over frequency (if the frequency exceeds 55hz then the device shows **o-F** on the buttom screen and opens its output contact at the end of t-2 delay).
- If o-F = oFF and u-F = 45 Hz then the device protects from under frequency (if frequency drops below 45Hz then the device shows **u-F** on the buttom screen and opens its output contact at the end of t-2 delay).
- If o-F = oFF and u-F = oFF then the frequency protection is disabled.



Parameters :

The menu where protection functions are adjusted. To enter this menu press set button until set is shown on the nuttom screen. Parameters are as follow:

► **o-U : Over Voltage Adjustment** (230 V – 290 V)
If the phase – phase voltage exceeds the adjusted value then the device opens it output contacts at the end of t – 1 delay.

► **u-U : Under Voltage Adjustment** (150 V – 210 V)
If the phase – phase voltage drops below the adjusted value then the device opens it output contacts at the end of t – 1 delay.

► **t-1 : Openning Delay (Voltage)** (00,1 – 99,9 seconds)
If any of voltage faults occurs, and if it lasts for t-1 period then the device opens its output contact.

► **t-2 : Openning Delay (Frequency)**(00,1 – 99,9 seconds)
If any of freuqency faults occurs, and if it lasts for t-2 period then the device opens its output contact.

► **t-3 : Returning Delay (Voltage and Frequency)**(00,1 – 99,9 seconds)
To close the output contact after openning because of both voltage and frequency faults, the values should return to the normal ranges and after t-3 delay the device closes its output contact.

► **L-t : Locking Time** (001 – 060 minutes)
The device locks itself when the number of faults reaches the adjusted locking number within this locking time. This way the sistem is protected and the user has the chance to investigate the problem.

► **L-C : Locking Counter** (oto , 001 – 010)
The number of the faults allowed within the period L-t. If the number of the faults exceeds this adjusted counter value then the device locks itself. The user must press Reset button agter the fault passes in order to unlock the device. If L-C is set to **oto** then this property is inactive.

► **o-F : Over Frequency Adjustment**
It can be set between (o-F) = [(u-F) + 0,4]..... 70 Hz.
If it is set to o-F = oFF then this protection is disabled.

► **u-F : Under Frequency Adjustment**
It can be set between (u-F) = 40 Hz .....[(o-F) – 0,4] .
If it is set to u-F = oFF then this protection is disabled.

► **qut : Quit**
If Set button is pressed there then the device goes back to the measurement screen.

TECHNICAL DATA:

Rated Voltage (Un)	: 220Vac (L1-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Measurement Power Consumption	: <1VA
Voltage Measurement	: 10 – 500 Vac
Frequency Measurement	: 40 / 100 Hz
Measurement Sensitivity	: %1±1 digit
Measurement Catagory	: CAT III
Display	: 3 Digit x 2 line LED
Contact Current	: Max. 5A / 240Vac
Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Humidity	: %15 ..... %95 (without condensation)
Connection Type	: To front panel tap
Dimensions	: 72x72x80 mm

DV – 72 - 01C

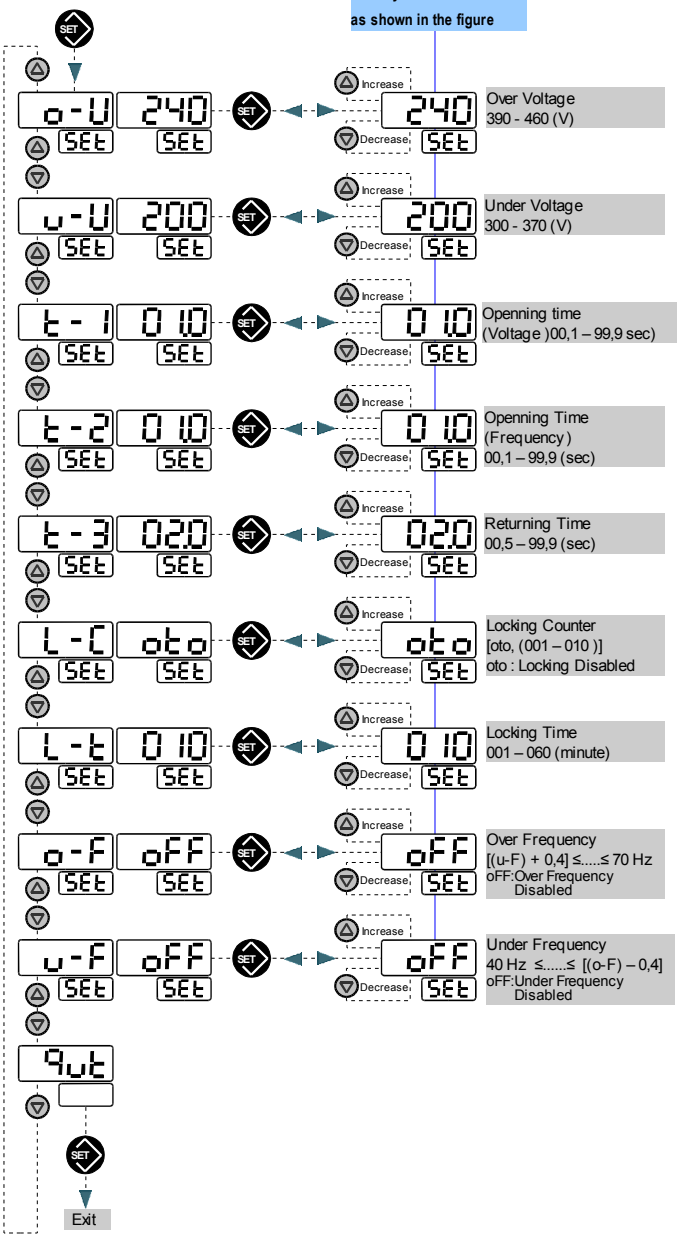
DIGITAL VOLTAGE & FREQUENCY MONITORING DEVICE

► True RMS

Accessing Parameter Menu

Press Set until Set is shown on the button screen.

Factory Default values are as shown in the figure



Over Voltage
390 - 460 (V)

Under Voltage
300 - 370 (V)

Openning time
(Voltage)00,1 – 99,9 sec)

Openning Time
(Frequency)
00,1 – 99,9 (sec)

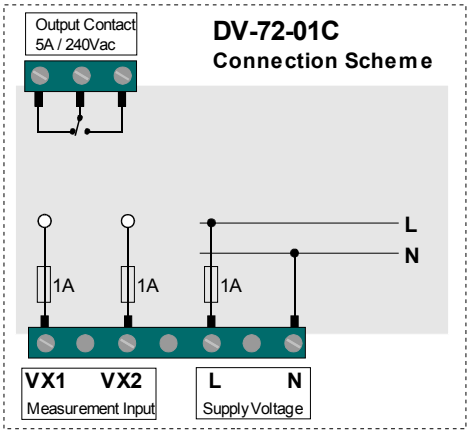
Returning Time
00,5 – 99,9 (sec)

Locking Counter
[oto, (001 – 010)]
oto : Locking Disabled

Locking Time
001 – 060 (minute)

Over Frequency
[(u-F) + 0,4] ≤.....≤ 70 Hz
oFF:Over Frequency Disabled

Under Frequency
40 Hz ≤.....≤ [(o-F) – 0,4]
oFF:Under Frequency Disabled



Dimesion of hole on the panel : 68 x 68 mm

Warning !!!
- The message Er1 or Er2 on the screen means that the dev ice has got a failure
- Clean the dev ice using dry dustcloth af ter de-energizing the dev ice
- Read and understand the instruction on this manual and attached label.

DV – 72 - 03C

DIGITAL VOLTAGE & FREQUENCY MONITORING DEVICE

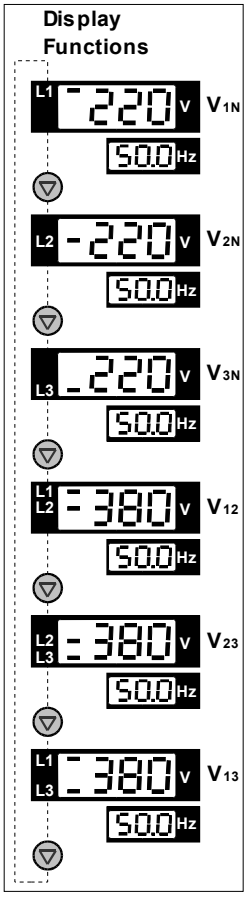
- ► True RMS
- ► Triphase controlled

General

The device measures the True RMS value of the voltage and frequency in tri-phase systems accurately. It is possible to observe the voltage value in the upper screen and the frequency value in the buttom screen simultaneously. Using the buttons, phase – nuetral and phase – phase voltages can be observed as shown in the figure in the right side.
The device contains many protections as follows:

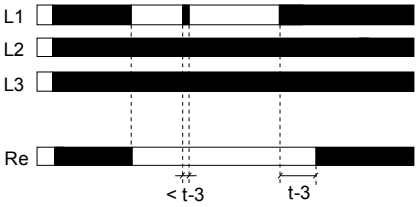
- ■ Phase failure.
- ■ Phase sequence.
- ■ Over Voltage protection.
- ■ Under voltage protection:
- ■ Unbalanced voltage protection.
- ■ Over frequency protection.
- ■ Under frequency protection.

As the device is beeing installed it closes its output contact if the voltage and frequency values are within the adjusted ranges and phase sequence is correct. In case of any previous mentioned faults (except of phase failure where openning is sudden) the the device opens its output contact at the end of delay adjusted by user. When the values return withiin the adjusted ranges the device closes its output contacts at the end of an adjusted delay.
Note: L1-N is the device's power supply inputs. Thus, the applied voltage must be the rated voltage of the system. The measured frequency also must the frequency of the system.



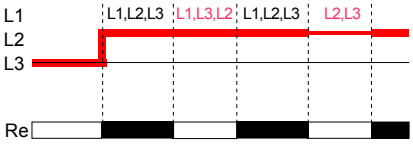
Phase Failure: (u-U)

When at least on of the three phases L1,L2,L3 is missing **u-U** is shown on the buttom screen and the device opens its output contact immediately.



Phase Sequence: (Seq)

Incase of wrong phase sequence, **Seq** is shown on the buttom screen and the device does not close its output contact. If the the sequence is corrected the device closes its output contacts

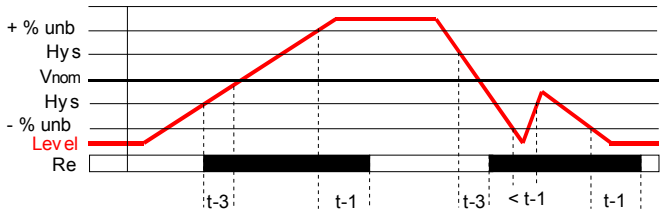


Unbalanced Voltage: (unb)

The phase – phase voltage unbalance limit can be adjusted between (%5 - %20). When it exceeds the adjusted limit **unb** is shown on the buttom screen and the device opens its output contact at the end of t – 1 delay.
It is needed for the device to close its output contact again that the voltage unbalance drops below the hysteresis percentage (%20). Thus, the device closes its output contact at the end of t – 2 delay.
Example: In tri-phase system where phase – phase voltage is 380 V.
The voltage unbalance limit is adjusted to %15. then the openning occures at: (380-(380 x 0,15) = 323 V. In order to close the output contact again the voltage should reach 323 + (380 x %15 x %20) = 334 V.

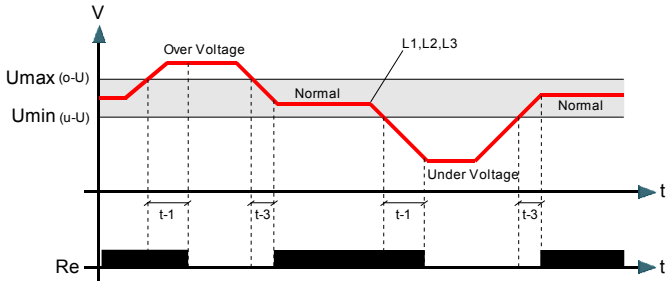
$$\%\,unb = \frac{(V_{max} - V_{min})}{380} \times 100$$

$$Hys = 380 \times (\%\,Asm) \times (\%\,20)$$



Over&Under Voltage : (o-U) (u-U)

Over voltage (o-U), it can ve adjusted between Umax= (390 – 460 V).
Under voltage (u-U), it can ve adjusted between Umin=(300 – 370 V).
Mentioned values are phase – phase voltages. If the voltage drops below the adjusted under voltage limit then **u-U** shows on the screen and the device closes it output contact after t-1 delay.
If the voltage excceeds the adjusted over voltage limit then **o-U** shows on the screen and the device closes it output contact after t-1 delay.
The hysteresis value is 6V.



Locking Property :

It can be controlled by two parameters; Locking Time and Locking Counter. If the number of openning reaches the adjusted locking counter within the adjusted locking time then the device opens its output contact and locks its functions until the user pressed **Reset** button. If the locking counter is adjusted to **oto** then this function is inactive and the device never locks itself

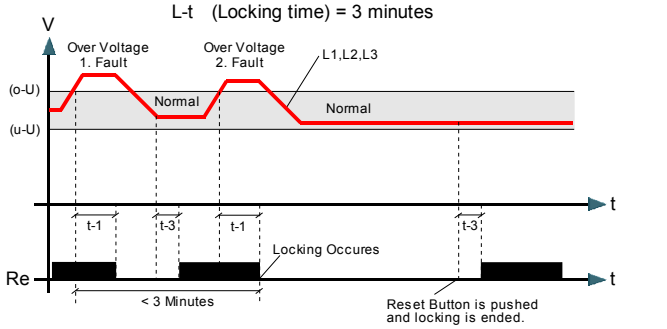
L-t : Locking Time (001 – 060 minutes)

It is well known the the frequentely occuring faults may damage the system. For that the device locks itself when the number of faults reaches the adjusted locking number within this locking time. This way the sistem is protected and the user has the chance to investigate the problem.

L-C : Locking Counter (oto , 001 – 010)

The number of the faults allowed within the period L-t. If the number of the faults exceeds this adjusted counter value then the device locks itself. The user must press Reset button agter the fault passes in order to unlock the device. If L-C is set to **oto** then this property is inactive.

If: L-C (Locking counter) = 2
L-t (Locking time) = 3 minutes



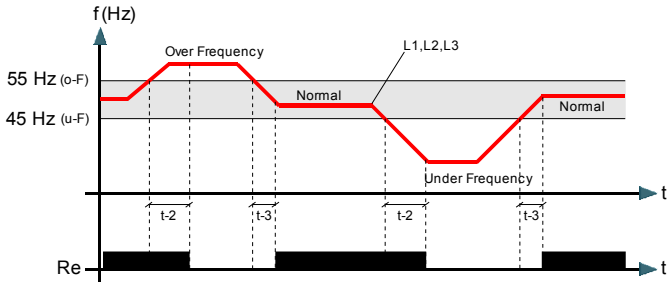
DV – 72 - 03C

DIGITAL VOLTAGE & FREQUENCY MONITORING DEVICE

- ► True RMS
- ► Triphase controlled

Over and/or Under Frequency Protection : (40 – 70 Hz)

Under frequency can be adjusted be tween (u-F) = 40 Hz .....[(o-F)-0,4]
Over frequency can be adjusted between (o-F) = [(u-F) + 0,4]..... 70 Hz.
It is possible to activate one or two of these protections or deactivate them both.
■ If o-F = 55 Hz and u-F = oFF then the device protects from over frequency (if the frequency exceeds 55hz then the device shows **o-F** on the buttom screen and opens its output contact at the end of t-2 delay).
■ If o-F = oFF and u-F = 45 Hz then the device protects from under frequency (if frequency drops below 45Hz then the device shows **u-F** on the buttom screen and opens its output contact at the end of t-2 delay).
If o-F = oFF and u-F = oFF then the frequency protection is disabled.



Parameters :
The menu where protection functions are adjusted. To enter this menu press set button until set is shown on the nuttom screen. Parameters are as follow:

► **o-U : Over Voltage Adjustment** (390 V – 460 V)
If the phase – phase voltage exceeds the adjusted value then the device opens it output contacts at the end of t – 1 delay.

► **u-U : Under Voltage Adjustment** (300 V – 370 V)
If the phase – phase voltage drops below the adjusted value then the device opens it output contacts at the end of t – 1 delay.

► **unb : Voltage Unbalance Adjustment** (0,05 – 0,20)%5 - 20
Unbalance between the phase – phase voltages, when the unblanace exceeds the adjusted value then the device opens it output contacts at the end of t – 1 delay.

► **t-1 : Openning Delay (Voltage)** (00,1 – 99,9 seconds)
If any of voltage faults occurs, and if it lasts for t-1 period then the device opens its output contact.

► **t-2 : Openning Delay (Frequency)**(00,1 – 99,9 seconds)
If any of freuqency faults occurs, and if it lasts for t-2 period then the device opens its output contact.

► **t-3 : Returning Delay (Voltage and Frequency)**(00,1 – 99,9 seconds)
To close the output contact after openning because of both voltage and frequency faults, the values should return to the normal ranges and after t-3 delay the device closes its output contact.

► **L-t : Locking Time** (001 – 060 minutes)
The device locks itself when the number of faults reaches the adjusted locking number within this locking time. This way the sistem is protected and the user has the chance to investigate the problem.

► **L-C : Locking Counter** (oto , 001 – 010)
The number of the faults allowed within the period L-t. If the number of the faults exceeds this adjusted counter value then the device locks itself. The user must press Reset button agter the fault passes in order to unlock the device. If L-C is set to **oto** then this property is inactive.

► **o-F : Over Frequency Adjustment**
It can be set between (o-F) = [(u-F) + 0,4]..... 70 Hz.
If it is set to o-F = oFF then this protection is disabled.

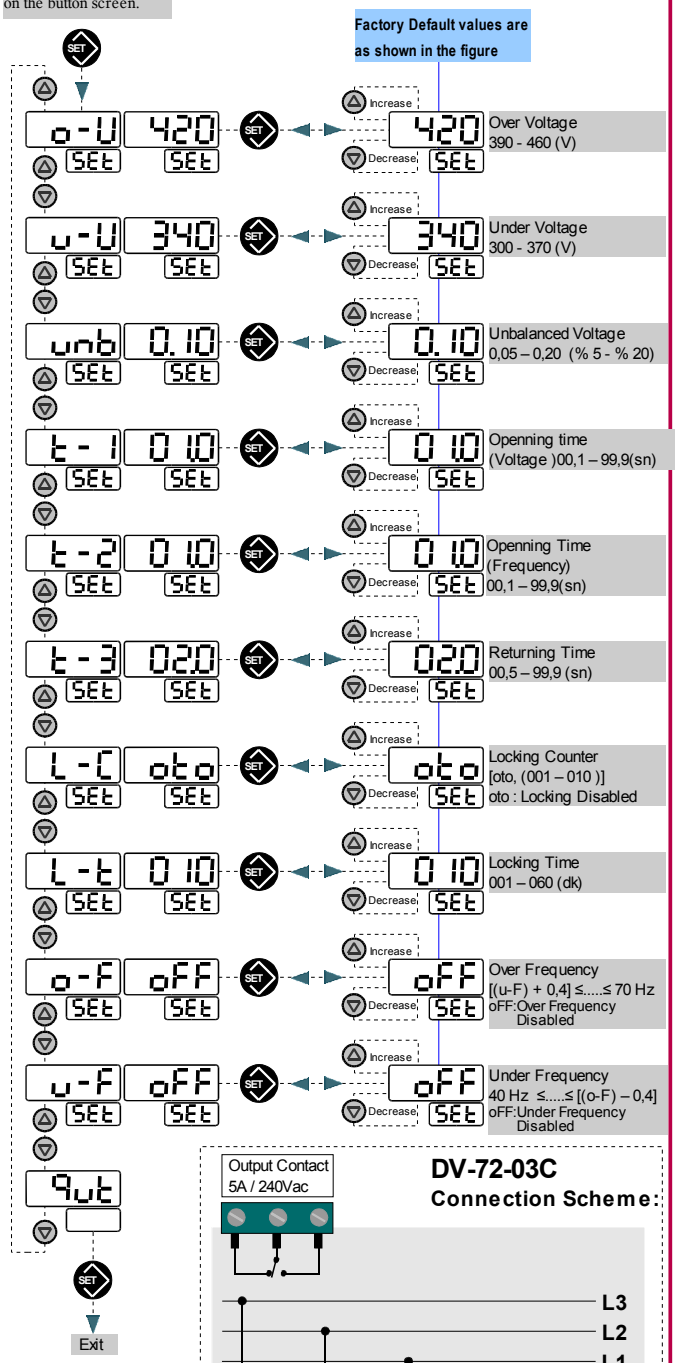
► **u-F : UnderFrquency Adjustment**
It can be set between (u-F) = 40 Hz .....[(o-F) – 0,4] .
If it is set to u-F = oFF then this protection is disabled.

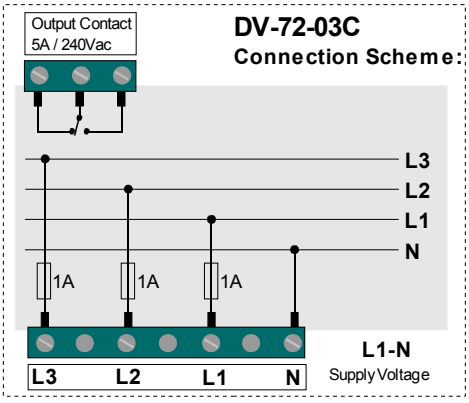
► **qut : Quit**
If Set button is pressed there then the device goes back to the measurement screen.

Warning !!!
■ The message Er1 or Er2 on the screen means that the dev ice has got a failure
■ Clean the dev ice using dry dustcloth af ter de-energizing the dev ice
■ Read and understand the instruction on this manual and attached label.

Accessing Parameter Menu

Press Set until Set is shown on the button screen.


Factory Default values are as shown in the figure
SET
o-U 420 SEt
u-U 340 SEt
unb 0.10 SEt
t-1 010 SEt
t-2 010 SEt
t-3 020 SEt
L-C oto SEt
L-t 010 SEt
o-F oFF SEt
u-F oFF SEt
qut
Increase
Decrease
Over Voltage 390 - 460 (V)
Under Voltage 300 - 370 (V)
Unbalanced Voltage 0,05 – 0,20 (% 5 - % 20)
Openning time (Voltage)00,1 – 99,9(sn)
Openning Time (Frequency) 00,1 – 99,9(sn)
Returning Time 00,5 – 99,9 (sn)
Locking Counter [oto, (001 – 010)] oto : Locking Disabled
Locking Time 001 – 060 (dk)
Over Frequency [(u-F) + 0,4] ≤.....≤ 70 Hz oFF:Over Frequency Disabled
Under Frequency 40 Hz ≤.....≤ [(o-F) – 0,4] oFF:Under Frequency Disabled
Exit



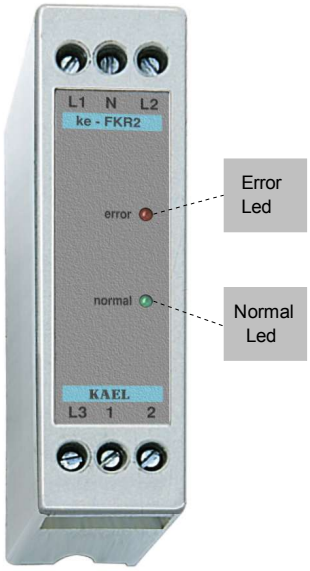
TECHNICAL DATA:

Rated Voltage (Un)	: 220Vac (L1-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Pow er Consumption	: < 4VA
Voltage Measurement	: 10 – 500 Vac
Frequency Measurement	: 40 / 100 Hz
Measurement Pow er Consumption:	<1VA
Measurement Sensitiv ity	: %1±1 digit
Measurement Catagory	: CAT III
Display	: 3 Digit x 2 line LED
Contact Current	: Max. 5A / 240Vac
Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Humidity	: %15 ..... %95 (w ithout condensation)
Connection Type	: To front panel tap
Dimensions	: 72x72x80 mm

ke – FKR2

PHASE FAILURE and PHASE SEQUENCE DEVICE

- ► Constant Voltage Asymmetry (Phase – Neutral 40%)
- ► Phase Sequence
- ► Phase Failure

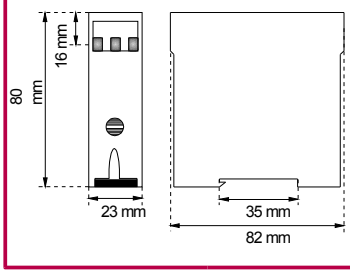


Application Areas:

- ■ Protection of electrical motors
- ■ Protection of 3 phase systems

TECHNICAL DATA:

Rated Voltage	: 3 Phase and 1 Neutral 220 VAC
Operating Range	: (0.8 – 1.2)xUn (Un nominal voltage)
Frequency	: 50 Hz
Asymmetry Adj.	: Phase to Neutral 40% constant
Output Contacts (1-2)	: Normally Open Contact
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm

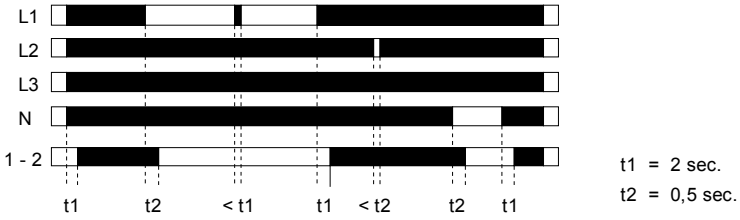


General:

In three phase systems, when phase sequence is correct and there is no asymmetry between phases, ***normal*** LED is turned on and relay contact is energised. Protection functions of ke-FKR2 are given below.

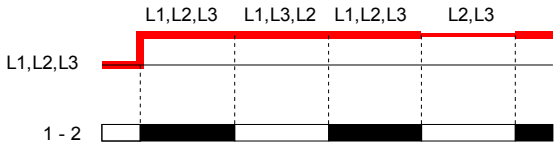
► **Phase Failure:**

In case of absence of at least one phase, relay immediately de-energises its contact and ***Error*** LED is turned on.



► **Phase Sequence:**

In case of wrong phase order, ***Error*** LED is turned on and relay does not energise its contact. If phase order is corrected, ***Error*** LED is turned off and relay energises its contact.



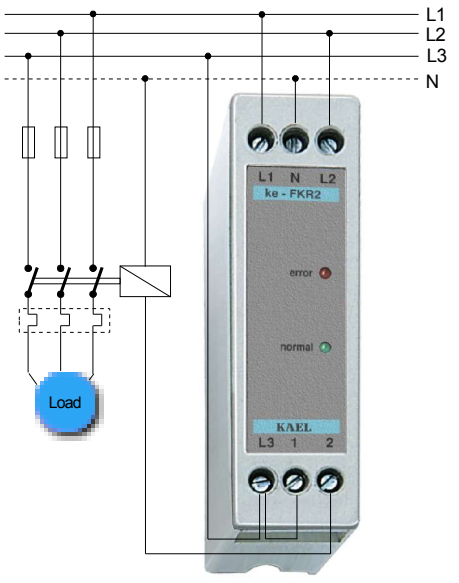
► **Voltage Asymmetry :**

Phase to neutral asymmetry is fixed 40%. If asymmetry exceeds this value, ***Error*** LED is turned on and relay contact is de-energised.
To return normal state, voltage asymmetry value must be under 15% (hysteresis).

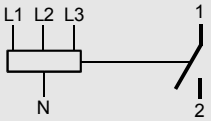
$$\text{Asym } \% = \frac{(V_{max} - V_{min})}{220} \times 100$$

Hys = 15 %

Simple Connection :



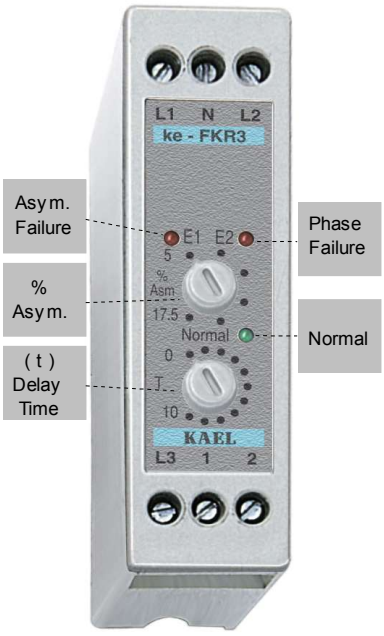
L1,L2,L3 : 3 x 380 V ac
L1,N : 220 V ac



ke – FKR3

PHASE FAILURE and PHASE SEQUENCE DEVICE

- ► Asymmetry % Adjustment
- ► Phase Sequence
- ► Phase Failure
- ► Delay Time Adjustment

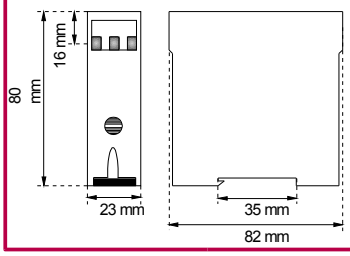


Application Areas:

- ■ Protection of electrical motors
- ■ Protection of 3 phase systems

TECHNICAL DATA:

Rated Voltage	: 3 Phase and 1 Neutral 220 VAC
Operating Range	: (0.8 – 1.2)xUn (Un nominal voltage)
Frequency	: 50 Hz
Asymmetry Adj.	: Phase to phase 5 - 17,5%
Delay Time Adj.	: 1 – 10 sec.
Output Contacts (1-2)	: Normally Open Contact
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm

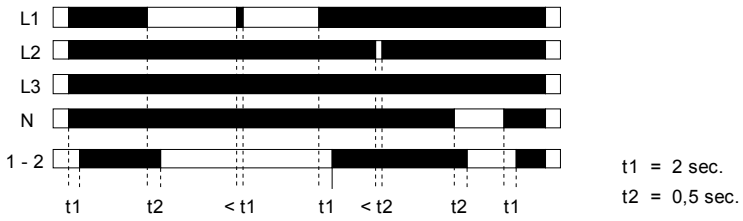


General:

In three phase systems, when phase sequence is correct and there is no asymmetry between phases, ***normal*** LED is turned on and relay contact is energised. Protection functions of ke-FKR3 are given below.

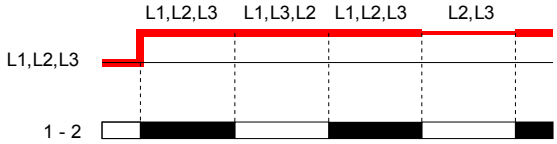
► Phase Failure:

In case of absence of at least one phase, relay immediately de-energises its contact and ***E2*** LED is turned on.



► Phase Sequence:

In case of wrong phase order, both of ***E1*** and ***E2*** LEDs are turned on at the same time and relay does not energise its contact. If phase order is corrected, both of ***E1*** and ***E2*** LEDs are turned off and relay energises its contact.



► Voltage Asymmetry (asym. %) (5-17.5 %) :

Phase to phase asymmetry is adjusted using the adjustment knob in the range of (5-17.5%). If asymmetry exceeds adjusted value, LED ***E1*** starts to flash and at the end of delay time (1-10s) ***E1*** LED is turned on continuously and relay contact is de-energised.

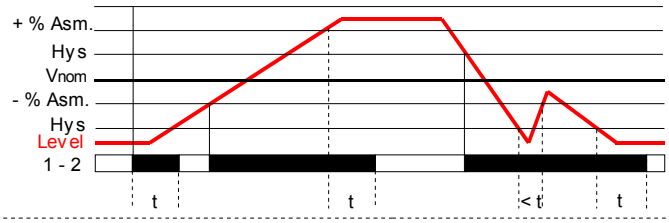
To return normal state, voltage asymmetry value must be under 20% of adjusted value (hysteresis). If phase – phase asymmetry value returns to normal region in a shorter time then adjusted delay time, relay does not de-energise its contact and LED ***E1*** stops flashing.

Example: Let's say that asymmetry value is set to 15% for a 3 x 380VAC. In this case, relay contact is de-energised at (380-(380x0.15))=323 V.

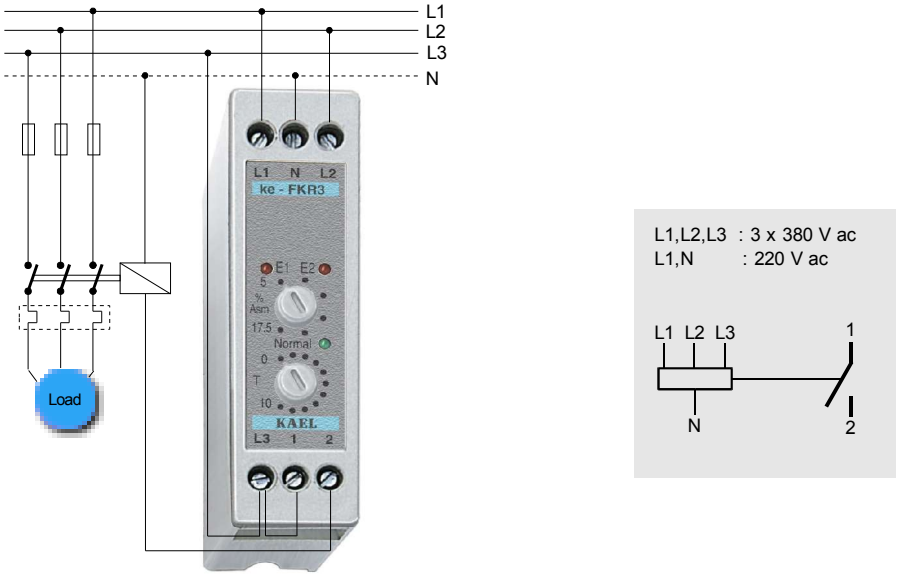
Re-energising the contact is performed at 323+(380x15%x20%)= 334V. (20% is the hysteresis).

$$\text{Asym } \% = \frac{(V_{max} - V_{min})}{220} \times 100$$

$$\text{Hys} = 380 \times (\text{Asym}\,\%) \times (20\,\%)$$



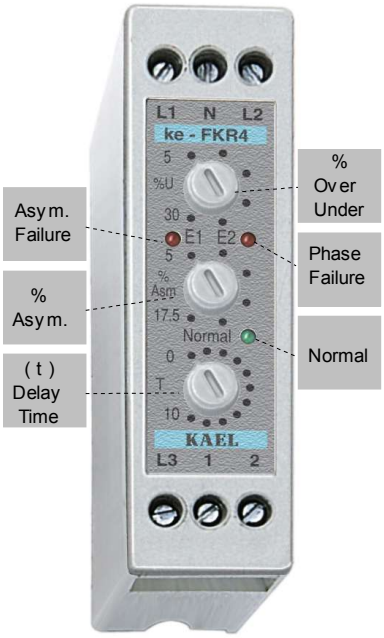
Simple Connection :



ke – FKR4

PHASE FAILURE and PHASE SEQUENCE DEVICE

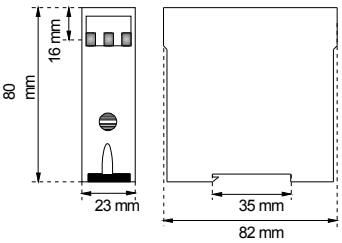
- ► Asymmetry % Adjustment
- ► Phase Sequence
- ► Over&Under Voltage % Adjustment
- ► Phase Failure
- ► Delay Time Adjustment



Application Areas:
-Protection of electrical motors
-Protection of 3 phase systems

TECHNICAL DATA:

Rated Voltage	: 3 Phase and 1 Neutral 220 VAC
Operating Range	: (0.8 – 1.2)xUn (Un nominal voltage)
Frequency	: 50 Hz
Asymmetry Adj.	: Phase to phase 5 - 17,5%
Over-Under Adj.	: Phase to Neutral 5 – 30%
Delay Time Adj.	: 1 – 10 sec.
Output Contacts (1-2)	: Normally Open Contact
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm

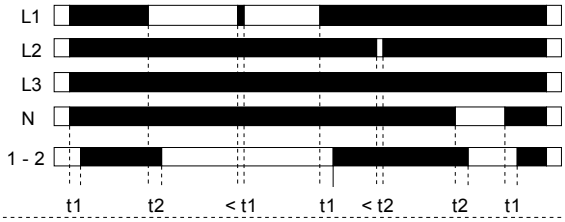


General:

In three phase systems, when phase sequence is correct and there is no asymm
normal LED is turned on and relay contact is energised. Protection functions of ke-FKR4 are given below.

► Phase Failure:

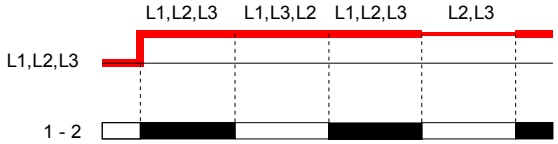
In case of absence of at least one phase, relay immediately de-energises its contact and ***E2*** LED is turned on.



t1 = 2 sec.
t2 = 0,5 sec.

► Phase Sequence:

In case of wrong phase order, both of ***E1*** and ***E2*** LEDs are turned on at the same time and relay does not energise its contact. If phase order is corrected, both of ***E1*** and ***E2*** LEDs are turned off and relay energises its contact.

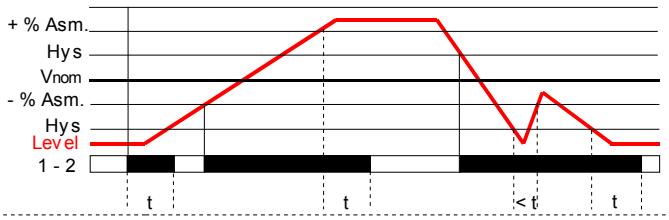


► Voltage Asymmetry (asym. %) (5-17.5 %) :

Phase to phase asymmetry is adjusted using the adjustment knob in the range of (5-17.5%). If asymmetry exceeds adjusted value, LED ***E1*** starts to flash and at the end of delay time (1-10s) ***E1*** LED is turned on continuously and relay contact is de-energised.
To return normal state, voltage asymmetry value must be under 20% of adjusted value (hysteresis). If phase – phase asymmetry value returns to normal region in a shorter time then adjusted delay time, relay does not de-energise its contact and LED ***E1*** stops flashing.
Example: Let's say that asymmetry value is set to 15% for a 3 x 380VAC. In this case, relay contact is de-energised at (380-(380x0.15))=323 V.
Re-energising the contact is performed at 323+(380x15%x20%)= 334V. (20% is the hysteresis).

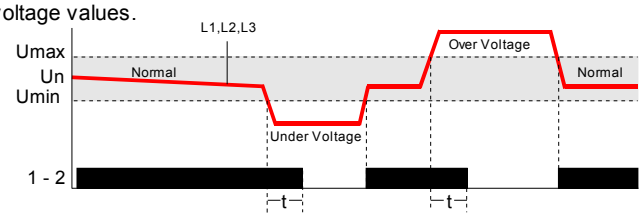
$$\text{Asym } \% = \frac{(V_{max} - V_{min})}{220} \times 100$$

Hys = 380 x (Asym %) x (20 %)

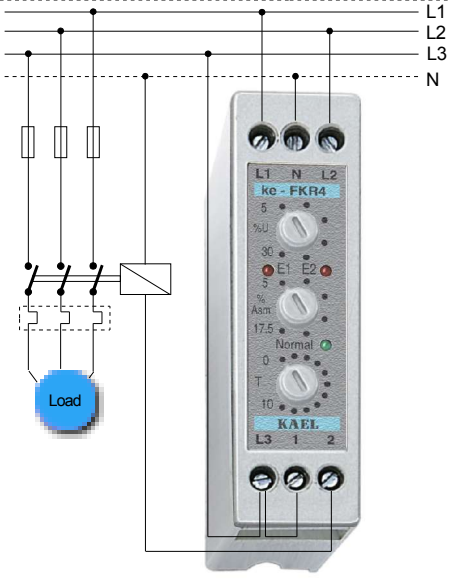


► Voltage Adjustment Range: ± (0,5 - 0,30)

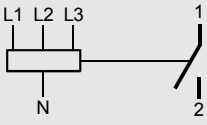
Under Voltage Umin=(0.70-0.95)xUn and Over Voltage Umax=(1.05-1.30)xUn.
As long as the voltage values do not exceed adjusted values, ***normal*** LED is kept on and relay contact is energised. Hysteresis is 15%. LED ***E2*** indicates that the adjusted voltage range is exceeded. There is only one adjustment knob for both over and under voltage values.



Simple Connection :



L1,L2,L3 : 3 x 380 V ac
L1,N : 220 V ac



ke-FKR4 (D)

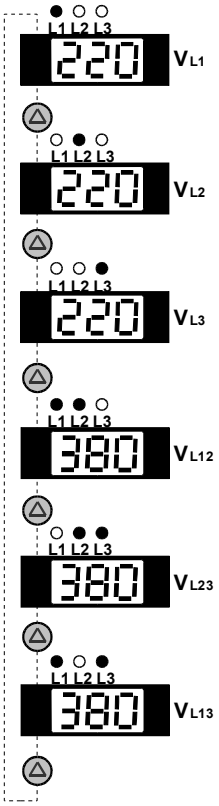
Digital Phase Failure and Phase Sequence Device

- V_{L1}, V_{L2}, V_{L3} $V_{L12}, V_{L23}, V_{L13}$
- Phase Sequence Control
- Over Voltage Protection
- Under Voltage Protection
- Unbalanced Voltage Protection
- Over Frequency Protection
- Under Frequency Protection
- Latch Function
- TRUE RMS

General
In three phase systems, it measures RMS values of AC voltages and system frequency sensitively. Using up direction button (Select) phase-neutral voltages and phase-phase voltages monitor sequentially ke-FKR4(D) has many features.
Those are;
- Phase Failure
- Phase Sequence
- Over Voltage Protection
- Under Voltage Protection
- Voltage Unbalance (asymmetry) Protection
- Over Frequency Protection
- Under Frequency Protection

When device is turn on if its adjusted voltages and frequency in its interval and if phase sequence is correct relay switch on. If any of error occurred (except phase failure and phase sequence) at the end of adjusted time relay switch off its contact. When system return normal values, at the end of time out relay switch on.

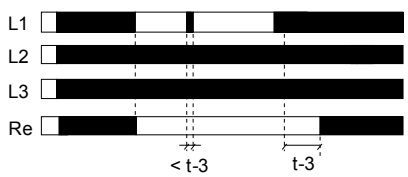
Display Function:



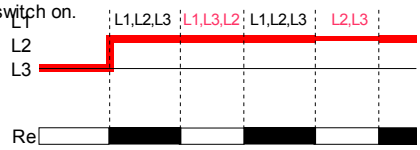
Select:(Up direction) when pressing continuously, screen displays frequency of system. When button release device continue to show voltage.

IMPORTANT: L1 - N is device supply inputs. Thus,the applied L1 – N voltage must be rated voltage of system .
The measured frequency also must the frequency of the system.

Phase Failure: (u-U)
Before starting system , it controls phase absence then if all phases exits Normal LED turn on and relay contact switch on. In case of missing of any L1,L2,L3 phases , Normal LED turn off and relay switch off its contact .In this case when pressing Reset button, **u-U** warn appears on display.



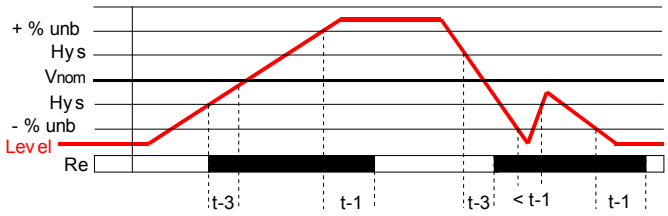
Phase Sequetion: (Seq)
In case of wrong phase order , Normal LED turned off and relay contact is not switch on. In this case if Reset button pushes **seq** warn displayed.if phase order is corrected , Normal LED turned on and out relay switch on.



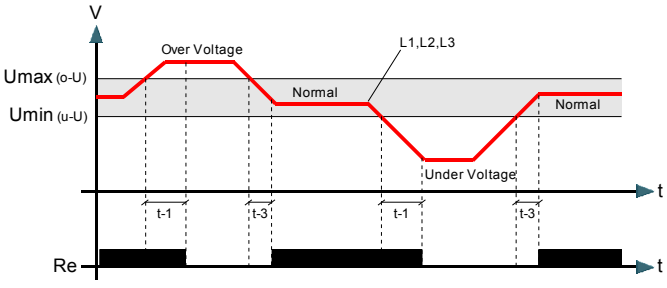
Voltage Unbalanced: (unb)
The phase-phase voltage unbalance limit can be adjusted between(%5-%20) . When it exceeds the adjusted limit , the device switched off its out contact at the end of t-1 delay. In this case when pushing Reset button **unb** warn appear on the screen. For the returning normal state, asymmetry values should under % 20 (hysteresis value). In this case at the end of t3 time Normal LED turned on and output contact switch on. If the phase-phase voltage unbalance, return adjusted value shorter than t-1 time, output relay does not release its contact. Hysteresis is %20.
.
Example: Let's say that asymmetry value is set to 15% for a 3 x 380VAC. In this case, relay contact switch off at (380-(380x0.15))=323 V.
Switch on the contact is performed at 323+(380x15%x20%)= 334V.
(20% is the hysteresis).

$$\%\,unb = \frac{(V_{max} - V_{min})}{380} \times 100$$

$$Hys = 380 \times (\%\,Asm) \times (\%\,20)$$



Over and Under Voltage : (o-U),(u-U)
Under voltage (u-U) it can adjusted between Umin= (300 – 370 V).
Over voltage (o-U) it can adjusted between Umax=(390 – 460 V).
If the voltage drops below the adjusted under voltage limit, when **u-U shows** on the screen and device switch off its output contact end of the t-1 time Normal LED turned on .In this case when pushing Reset button **u-U** warn appear on its screen.
If the voltage exceed the adjusted over voltage limit, Normal LED turned off and output relay switch off. In this case when pushing Reset button **o-U warn** appers **on** its screen.



LOCKING FUNCTION : (LATCH)
It can be controlled by two parameters. Locking time and Locking counter. If the number of opening reaches the adjusted locking counter withing the adjusted locking time then device switch off its contact and locks its functions until the user pressed **Reset** button.
If the locking counter is adjusted to **oto** then this function is disable and device never locks itself.

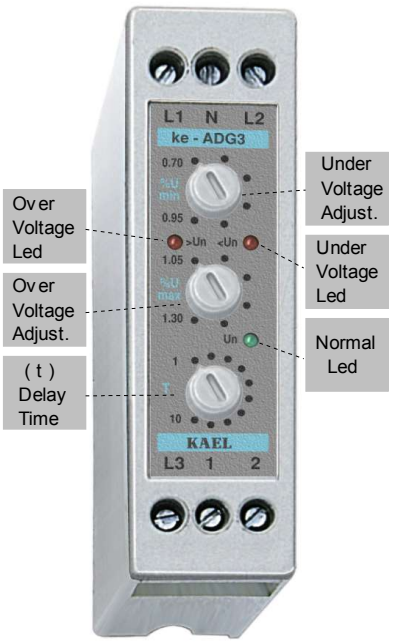
L-t : Locking Time (001 – 060 min.)
It is well know the frequently occurring faults may damage system. For that the device when number of faults reaches the adjusted locking number within this locking time. This way the system is protected and user has chance to investigate the problem.

L-C : Locking Counter (oto , 001 – 010 piece)
The number of faults allowed within the period L-t. If number of faults exceeds this adjusted counter value device locks itself. User must press Reset button then the fault passes in order to unlock the device.
If **L- C** is set to **oto** then this property is disabled.

ke – ADG

OVER and UNDER VOLTAGE CONTROL RELAY

- ► Over&Under Voltage % Adjustment
- ► Phase Failure
- ► Phase Sequence
- ► Delay Time Adjustment



TYPE	Voltage Adjustment Range %		Time Delay	Function	Sudden Switch OFF < 0,65xUn >1,35xUn	Phase Sequence Control	3 Phase	1 Phase	Applications
	Under Voltage % (< Un)	Over Voltage % (> Un)							
Ke-ADG31	(0,70-0,95) x Un	(1,05-1,30) x Un	1-10 seconds	OFF delay	●		●		Control compensation equipments,electrical motors,power capacitance
Ke-ADG32	(0,85-0,97) x Un	(1,03-1,15) x Un	1-10 seconds	OFF delay	●		●		
Ke-ADG33	(0,70-0,95) x Un	(1,05-1,30) x Un	1-10 seconds	OFF delay	●	●	●		
Ke-ADG34	(0,85-0,97) x Un	(1,03-1,15) x Un	1-10 seconds	OFF delay	●	●	●		
Ke-ADG35	(0,70-0,95) x Un	(1,05-1,30) x Un	1-10 minutes	ON delay	●		●		Air conditioner and compressors
Ke-ADG36	(0,85-0,97) x Un	(1,03-1,15) x Un	1-10 seconds	ON delay	●		●		
Ke-ADG37	(0,70-0,95) x Un	(1,05-1,30) x Un	1-10 seconds	ON delay	●	●	●		
Ke-ADG38	(0,85-0,97) x Un	(1,03-1,15) x Un	1-10 seconds	ON delay	●	●	●		
Ke-ADG11	(0,70-0,95) x Un	(1,05-1,30) x Un	1-10 seconds	OFF delay	●			●	Remote control, control equipments
Ke-ADG12	(0,85-0,97) x Un	(1,03-1,15) x Un	1-10 seconds	OFF delay	●			●	
Ke-ADG15	(0,70-0,95) x Un	(1,05-1,30) x Un	1-10 minutes	ON delay	●			●	Air conditioner
Ke-ADG16	(0,85-0,97) x Un	(1,03-1,15) x Un	1-10 minutes	ON delay	●			●	

General:
Microprocessor controlled. Three or single phase relay is used in systems exposed to over or under voltage, such as command, control or compensation systems and protects devices such as condensers, motors, air conditioners and compressors.
It is divided into sub-categories depending on the voltage adjustment range, phase sequencing control, on or off start modes.

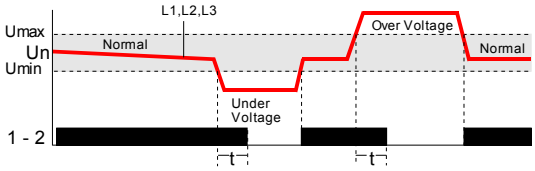
► **Phase Sequencing Control :** For the models with phase sequencing control, when device is energized, if the phase sequence is wrong, over (>Un) and under (<Un) LEDS are turned on together and phase sequence error is indicated. Meanwhile, Normal LED (Un) is turned off and relay contact is open circuit. In case of phase sequence is correct and phase voltages are in adjusted percentage range, the delay time for turning the Normal LED on and energizing the relay depends on the Off Delay or On Delay type of device. For further information please refer to graph 1 & 2 and Delay Time Modes section of this manual.

► **Sudden Switch Off :** When any phase voltage's difference respect to nominal voltage exceeds 35%, without any time delay Normal LED is turned off and relay contact is de-energized.

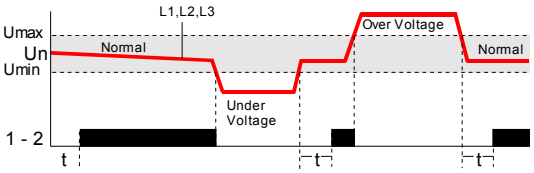
► **Voltage Adjustment Range :**
Umin= (0.70 – 0.95) x Un;
Umax= (1.05-1.30)xUn
When the adjusted limits are not exceeded, Normal (Un) LED is on and the relay contact is energized.

► **Delay Time Modes :** There are two types, one is Off-Delay and the other is On-Delay.

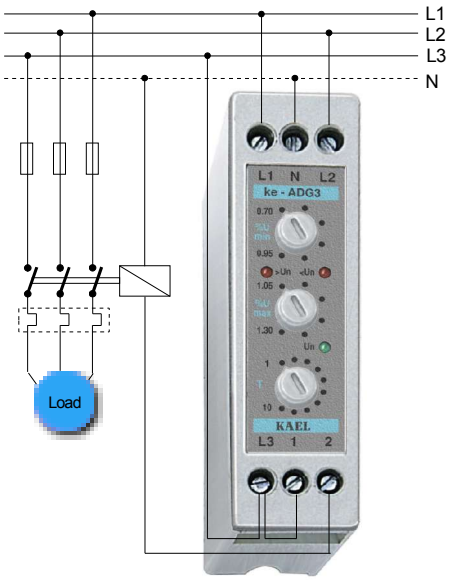
■ **Off Delay :** (refer graph 1)
If phase voltages are in the adjusted percentage range, normal LED turns on and relay contact is energized. When adjusted over or under voltage limit is exceeded 1-10 sec delay time is started.
During this time interval, appropriate error LED is also on together with Normal LED and at the end of delay time, Normal LED is turned on and relay contact is de-energized. When the error condition is disappeared, Normal LED is turned on and relay contact is re-energized.



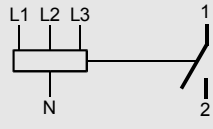
■ **On Delay :** If phase voltages are in the adjusted percentage range, adjusted delay time, 1-10 min, is counted and at the end of delay time Normal LED is turned on and relay contact is energized.
When adjusted over or under voltage limit is exceeded, Normal LED is turned on and relay contact is de-energized immediately, without waiting any delay time. When the phase voltages return into adjusted normal range (also considering the difference), adjusted 1-10 min delay time is counted and at the end of this time, Normal LED is turned on and relay contact is re-energized.



Simple Connection :

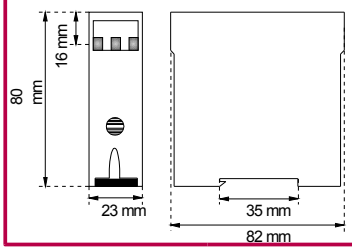


L1,L2,L3 : 3 x 380 V ac
L1,N : 220 V ac



TECHNICAL DATA:

Rated Voltage, Un	: 3 phase and 1 neutral 220 VAC
Operating Range	: (0,5-1,5) x Un (Un nominal votlage)
Frequency	: 50 Hz
Over and Under Voltage Adjustment Range	: Please refer to table
Delay Time Adj.	: Please refer to table
Sudden Switch Off	: Below Un x 0.65 and above Un x 1.35
Sudden Switch Off Time	: 500 msec
Output Contacts (1-2)	: Normally Open Contact
Contact Current	: max. 5A/240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5 °C.....+50 °C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm



ke – FKR1T

PHASE PROTECTION RELAY

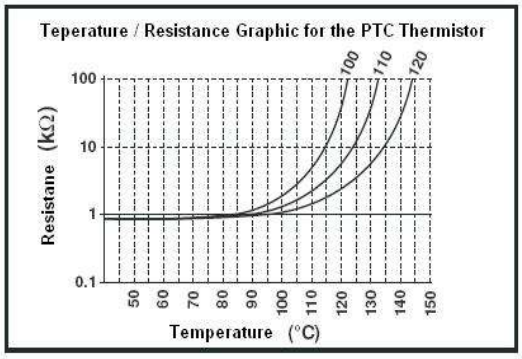
- ► Phase Failure
- ► PTC Protection

PHASE PROTECTION RELAY

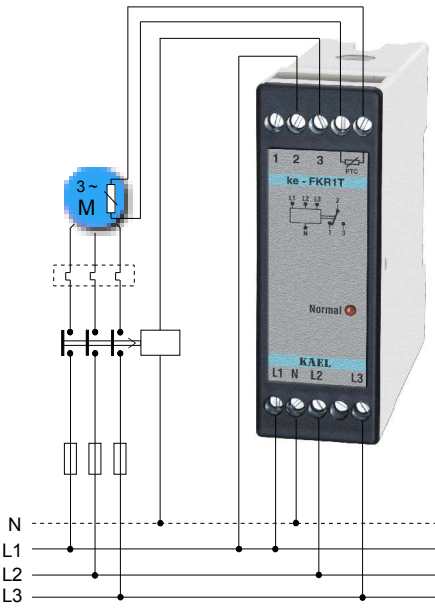
Operating Principle:

If all R, S, T phase voltages are balanced and there is no missing phase; normal LED turns on and the relay energizes its contact.
If phase-neutral voltage unbalance value exceeds ± 20 %, normal LED turns off and relay de-energizes its contact.
When the unbalance returns to normal boundary, normal LED turns on and the relay energizes its contact again.

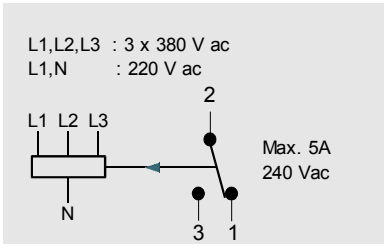
► **PTC Protection:**
If you have a device w ith PTC protection capability.
If you do not w ant to use this property, simply short circuit the PTC connections.



Simple Connection :

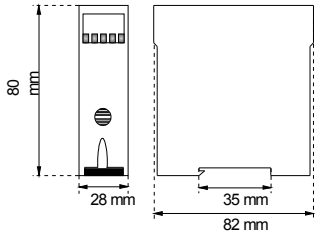


PTC inputs
if not used then
short cut them



TECHNICAL DATA:

Rated Voltage	: 3 Phase and 1 Neutral 220 VAC
Operating Range	: (0,8-1,2) x Un (Un nominal voltage)
Frequency	: 50 Hz
Energizing and de-energizing difference	: ± %3
Contact Current	: max. 5A/240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Operating Temperature	: -5 °C.....+50 °C
Connection Type	: To connection rail in electrical panel
Dimensions	: 28x82x80 mm

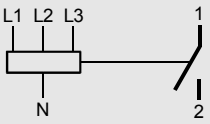


ke – FKR1

PHASE FAILURE DEVICE

► Phase Failure

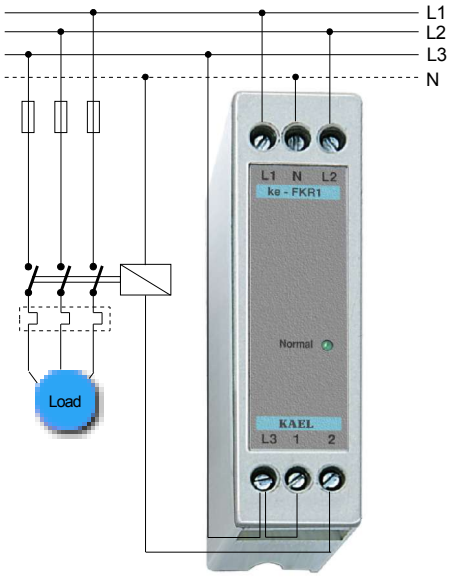
L1,L2,L3 : 3 x 380 V ac
L1,N : 220 V ac



► **Operating Principle:**

If all R, S, T phase voltages are balanced and there is no missing phase; normal LED turns on and the relay energizes its contact.
If phase-neutral voltage unbalance value exceeds ± 20 %, normal LED turns off and relay de-energizes its contact.
When the unbalance returns to normal boundary, normal LED turns on and the relay energizes its contact again.

Simple Connection :



Application Areas:

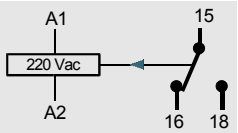
- Protection of electrical motors
- Protection of 3 phase systems

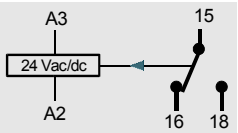
TECHNICAL DATA:

Rated Voltage	: 3 Phase and 1 Neutral 220 VAC
Operating Range	: (0.8 – 1.2)xUn (Un nominal voltage)
Frequency	: 50 Hz
Asymmetry Adj.	: Phase to Neutral 20% constant
Output Contacts (1-2)	: Normally Open Contact
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm

ke – ZR30

30 Sec. TIME RELAY

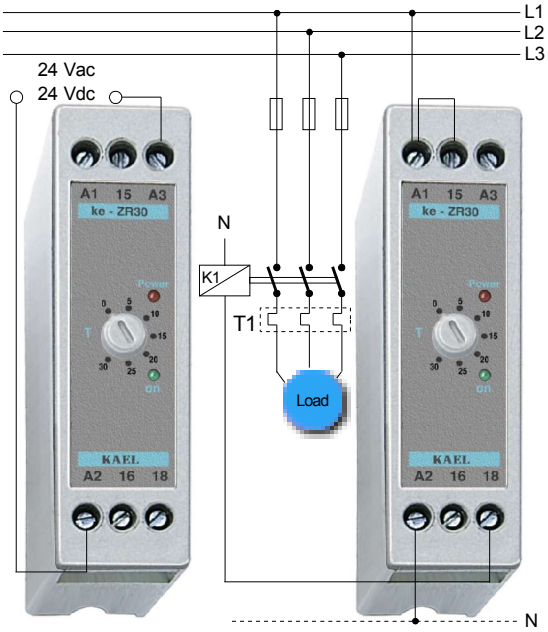




► **Operating Principle:**

When 220 Vac is feed from the A1 – A2 terminals, the power led becomes on and the time starts to count. At the end of the adjusted time, on led turns on and switches on the contact of the output relay.
Until the energy on the A1 and A2 terminals is cut off, the contacts don't change their positions. When the energy is cut off, the relay resets itself.

Simple Connection :



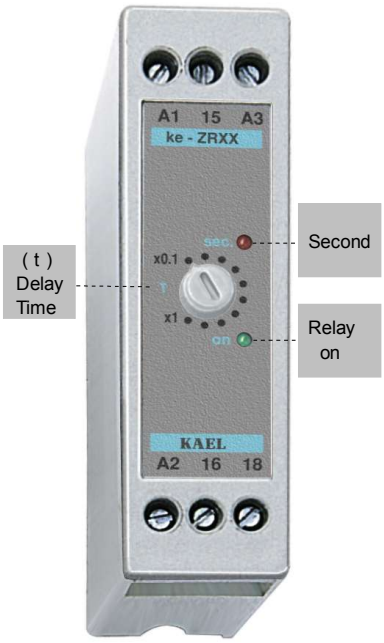
TECHNICAL DATA:

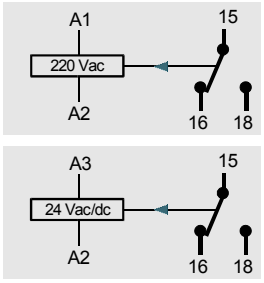
Operational Voltage (Un)	
A1 – A2 terminals	: 220 Vac
A3 – A2 terminals	: 24 Vac or 24 Vdc
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50 Hz
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm

ke – ZRXX

MULTI FUNCTION TIME RELAY

- ► 32 Time Interval Selection
- ► Off – On Delay Operation Selection
- ► 220 Vac or 24 V ac/dc



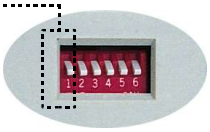


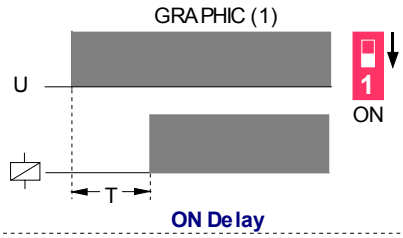
General:

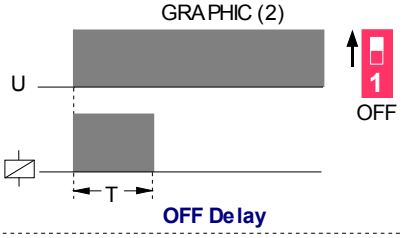
It is microprocessor controlled. It is possible to make 32 different time interval selections by using the dip-switch that is located near the equipment. Also, on-off start mode is selectable.

► **OPERATIONAL MODE SELECTION:**

The dip-switch, numbered as 1, determines the operational mode.
If it is adjusted to the on position, the equipment starts in on-delay mode (graphic 1).
While in the off position, it starts in off-delay mode (graphic 2).







► **TIME INTERVAL SELECTION:**

You may select the desired time interval by using the 2,3,4,5,6 numbered switches of the dip-switch that are at the side of the equipment. The time selection table is given below.

Min - Max	Min - Max	Min - Max	Min - Max
0,1 – 1sec	0,7 – 70sec	12 sec – 20 min	1 min – 100 min
0,1 – 5sec	0,8 – 80sec	18 sec – 30 min	2 min – 200 min
0,1 – 10sec	0,9 – 90sec	24 sec – 40 min	3 min – 5 hrs
0,2 – 20sec	1 – 100sec	30 sec – 50 min	6 min – 10 hrs
0,3 – 30seC	2 – 200sec	36 sec – 60 min	9 min – 15 hrs
0,4 – 40sec	3 sec - 5 min	42 sec – 70 min	12 min – 20 hrs
0,5 – 50sec	6 sec – 10 min	48 sec – 80 min	15 min – 25 hrs
0,6 – 60sec	9 sec - 15 min	54 sec – 90 min	18 min – 30 hrs

► THE TIME ADJUSTMENT SCALER:

The scaler of the adjustment potentiometer located over the equipment, is set from 0,1 to 1. When you select your adjustment with the dip-switch, it can be adjusted at the range specified by the interval mode, by the steps of 1%.

Example 1:

1sn–100sn

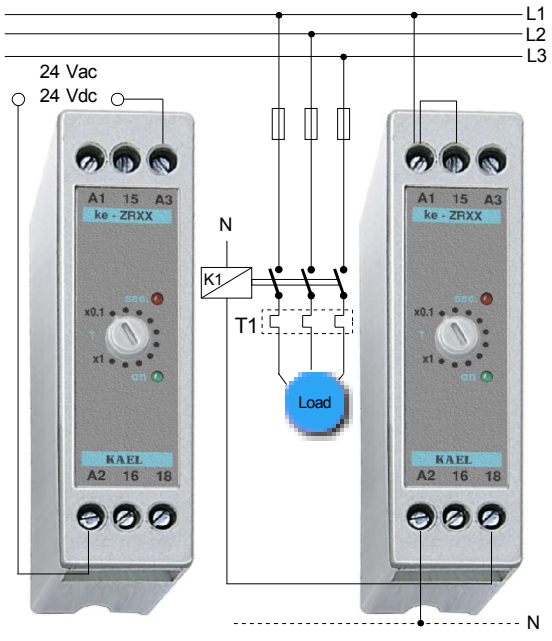
If you had already selected the time interval mode above, in the situation of the potentiometer becoming maximum, the relay would have counted 100 sec; while in minimum, it would have counted 1 sec. You can do your adjustment at steps of 1 sec. (The min. value in the table is the adjustment step period)

Example 2:

12sn–20 dk

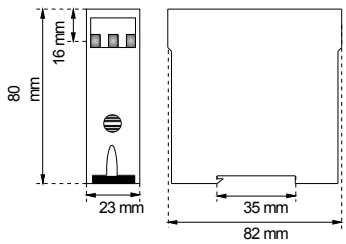
At this time interval, though you can do your adjustment in the of 12 sec. to max.1200 sec=20 minutes, by the steps of 12 sec (The min. value in the table is the adjustment step period). If you adjust the potentiometer to the 0,4 point on the scaler, the time counted by the equipment, will be calculated in the following manner. **Time =0,4 x 20 min=8 minutes** (The 20 minute value in the formula is the maximum value of the time interval that you have selected with the dip-switch).

Simple Connection :



TECHNICAL DATA:

Operational Voltage (Un)	
A1 – A2 terminals	: 220 Vac
A3 – A2 terminals	: 24 Vac or 24 Vdc
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50 Hz
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm



ke-ZRXX (D)

Multi Function Digital Timer

- Time Interval
  0,1 ..... 9999 sec
  0,1 ..... 9999 min
- 2 Relay Output
- 19 different function
- Start Input :
  NPN with proximity sensor or switch
- Easy Programming

General

Device is microprocessor based. Many time relay applications collect inside. Sensitively time adjustment of classic time relays cause problems,then it is developed fully digital. There are 19 different applications of functions selection inside. Moreover some applications need to start input. Because of this reason using with both NPN type proximity sensor and switch.

Advance Programming

For safe access parameters in this section ,pressing both up and down buttons during 2 sec. same time. Firstly during 1 sec Prog will appear then **P – ...** function number will appear and set LED start to flash.

Function Selection :

In this section determining device work in which function. Therefore need to enter number of selected function,In this section press Set button and when **P-....** flashing then using direction button come to related function number then press Set button to store.

For t1 Time Unit Selection : Minutes (min),Second (s)

According to selected function, device accessing to t1 unit if t2 available to t2 unit decide itself . After function selection when down button pressed t1-S displayed on screen which is relating to unit of first time (t1). While Set LED flashing Unit LED where is memory related t1 LED with t1 time (min or sec) turned on. For changing this unit press to Set button. t1-S appears ,Set LED and Unit LED flash. In this case using direction buttons provide turning on min(minute) or s(second) LED and repressed Set button stored selected time for t1.

For t1 Time Value Selection : 0,1 – 9999

After time unit selection when pressing down button one time then t1 value displays on the screen. Meanwhile turning on selected time unit LED and t1 LED Set LED flash. For changing value press SET button then numeric value,set LED and t1 LED start to flash. Using direction buttons come required time value and pressing SET to store value to memory.

For t2 Time Unit Selection : Minute (min), Second(s)

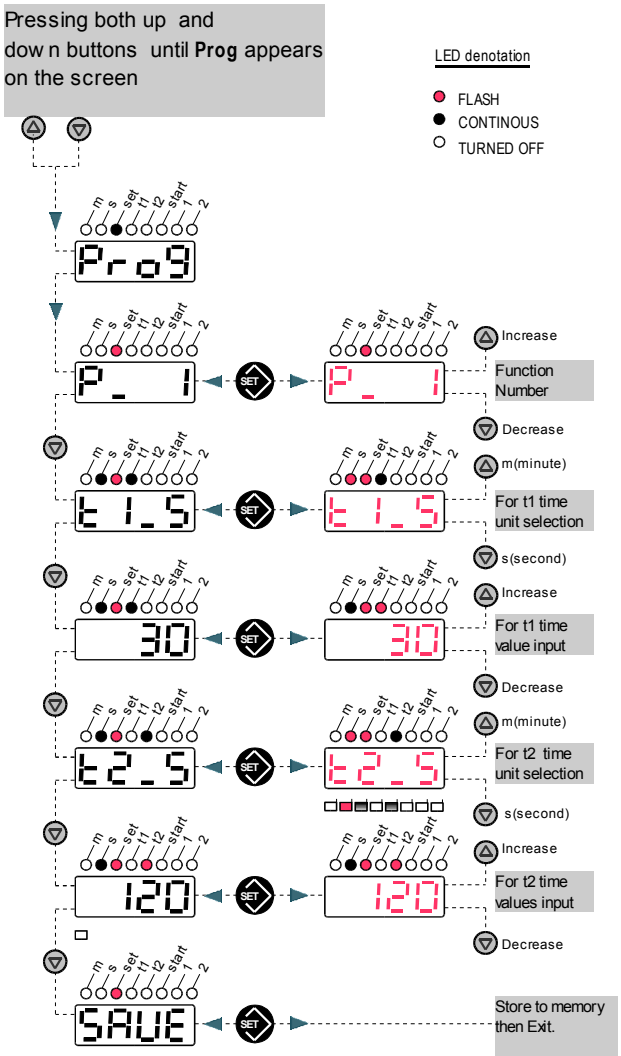
If t2 using only in selected function device turn on its t2 settings. Otherwise any parameter does not return related to t2. After time values selection for t1 then when press down button displays t2-S to screen, which is related to second time(t2) unit appears. While Set LED flashes unit LED(min or s) where is memory related t2 LED with t2 time. For changing this unit press to Set button t2-S appears,set LED and unit LED flash. In this case using direction buttons proving turning on min (minute) or s(second) and repress Set stored selected time for t2.

For t2 Time Value Selection : 0,1 – 9999

After time unit selection when down direction button press once t2`s numeric values appears. Meanwhile turning on selected time unit LED and t1 LED Set LED flash. For changing value press SET button then numeric value, set LED and t2 LED start to flash. Using direction buttons come required time value and pressing SET to store value to memory.

Storing Memory:

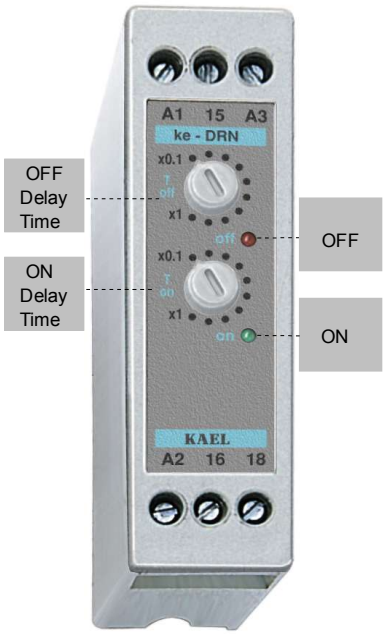
Press last of all down direction button and **SAVE** appears on the screen. In this case pressing Set button all data stored to memory and start work device according to function. If not press Set when device screen is SAVE all change cancel. Device continue to work current functions.



ke – DRN

MULTI RANGE, DOUBLE TIME ADJUSTED FLASHER RELAY

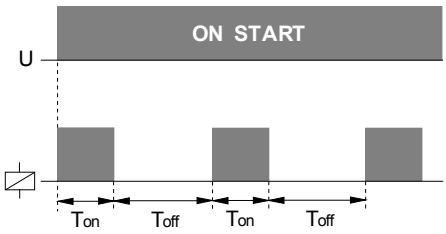
- ► 8 Items of ON time mode and
- ► 8 Items of OFF time mode selection
- ► 220 Vac or 24 V ac/dc



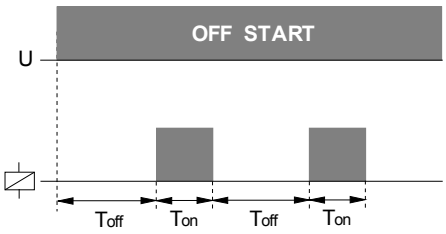
General:

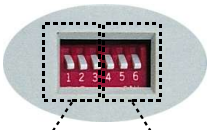
It is microprocessor controlled.8 different ON (operating) time interval and 8 different OFF (stand by) time interval mode selection can be made by the use of the dip-switch situated near the equipment.The selection of the ON and OFF time intervals are handled one by one.

ke-DRN1



ke-DRN2





OFF	ON
5 sec 123	5 sec 456
10 sec 123	10 sec 456
30 sec 123	30 sec 456
60 sec 123	60 sec 456
5 m 123	5 m 456
10 m 123	10 m 456
30 m 123	30 m 456
60 m 123	60 m 456

► **THE TIME INTERVAL SELECTION:**
The switches,numbered **1,2,3** of the dip-switch are used at the selection of the OFF time interval, the switches numbered **4,5,6** are used at the selection of the ON time interval.Below is the time selection table for ON and OFF conditions.

► **THE TIME ADJUSTMENT SCALER:**
The scale of the adjustment potentiometer located on the equipment, is set between 0,01 to 1.When you select your adjustment with the dip-switch,it can be adjusted at the range specified by the interval mode,by the steps of 1%.

Example 1:

OFF
6 sec. – 10 min.

Let's select the OFF (stand by) time interval as above and adjust the value of the T(off) potentiometer to 0,7.

ON
0,6 sec. – 60 sec

Let's select the ON (operating) time interval as above and adjust the T(on) potentiometer to 0,3.In this case,we can calculate the ON and OFF periods.

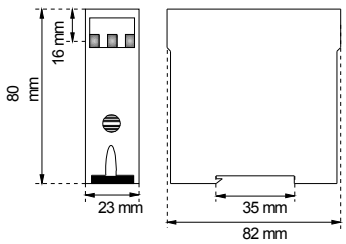
T(off) = 0,7 x 10 minutes = 7 minutes (The 10 minutes in the formula is the maximum value of the OFF time selected by the dip-switch)
T(on) = 0,3 x 60 seconds = 18 sec. (The 60 sec. in the formula is the maximum value of the ON time selected by the dip-switch)

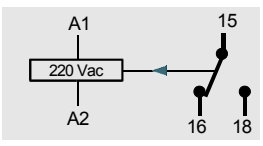
You may adjust;the OFF time with 6 second steps (the minimum value specified by the dip-switch indicates the adjustment step value),the ON time though,with 0,6 sec. Steps).

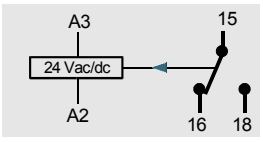
NOTE: During the operation of the relay ,you may change the time interval selections and potentiometer adjustment.In this case,it continues to evaluate the new selections.

TECHNICAL DATA:

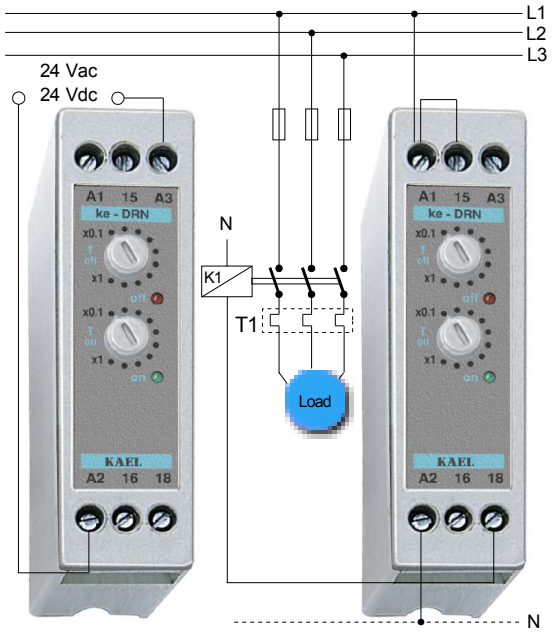
Operational Voltage (Un)	
A1 – A2 terminals	: 220 Vac
A3 – A2 terminals	: 24 Vac or 24 Vdc
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50 Hz
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm







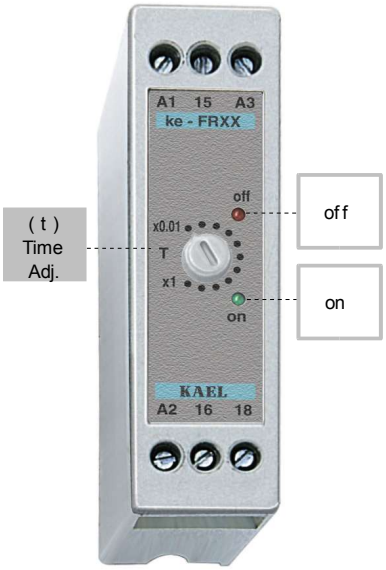
Simple Connection :

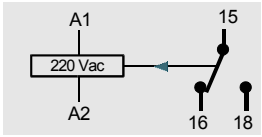


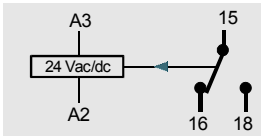
ke – FRXX

MULTI RANGE, TIME ADJUSTED FLASHER RELAY

- ► 16 Time interval swIwction
- ► 220 Vac or 24 V ac/dc

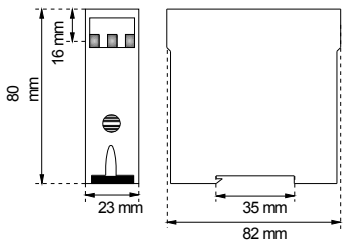




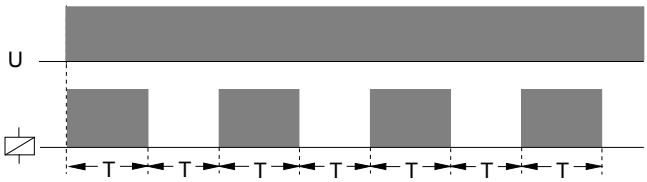


TECHNICAL DATA:

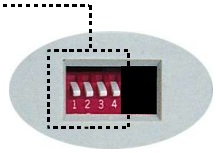
Operational Voltage (Un)	
A1 – A2 terminals	: 220 Vac
A3 – A2 terminals	: 24 Vac or 24 Vdc
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50 Hz
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm



General:
It is microprocessor controlled. It is possible to make 16 different time interval selections by using the dip-switch that is located near the equipment.



► **TIME INTERVAL SELECTION:**
You may select the desired time interval by using the 1,2,3,4 numbered switches of the dip-switch that are at the side of the equipment.The time selection table is given below.



Min - Max		Min - Max	
1 2 3 4	0,1 – 1sec	1 2 3 4	9 sec - 15 min
1 2 3 4	0,1 – 5sec	1 2 3 4	18 sec – 30 min
1 2 3 4	0,1 – 10sec	1 2 3 4	36 sec – 60 min
1 2 3 4	0,3 – 30sec	1 2 3 4	3 min – 5 hrs
1 2 3 4	0,6 – 60sec	1 2 3 4	6 min – 10 hrs
1 2 3 4	1 – 100sec	1 2 3 4	9 min – 15 hrs
1 2 3 4	3 sec - 5 min	1 2 3 4	15 min – 25 hrs
1 2 3 4	6 sec – 10 min	1 2 3 4	18 min – 30 hrs

► **THE TIME ADJUSTMENT SCALER:**

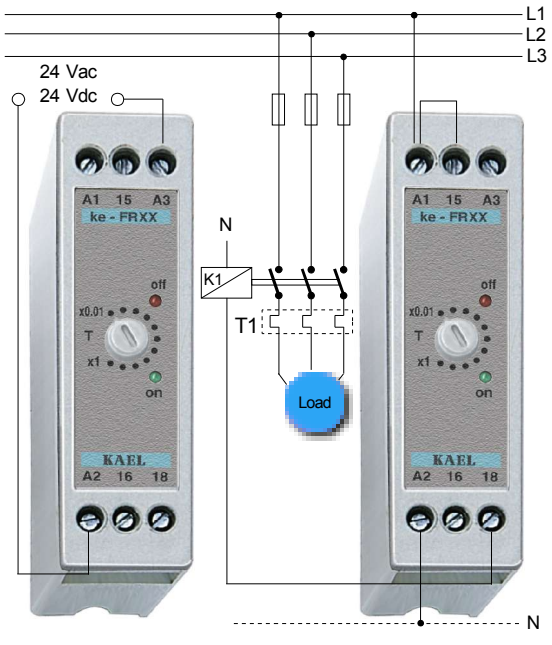
The scaler of the adjustment potentiometer located on the equipment, can be set between 0,1 to 1.
When you select your adjustment with the dip-switch, it can be adjusted at the range specified by the interval mode, by the steps of 1%.

Example :

1sn–100sn

If you had already selected the time interval mode above, in the situation of the potentiometer becoming maximum, the relay would have counted 100 sec; while in minimum, it would have counted 1 sec. You can do your adjustment at steps of 1 sec. (The min. value in the table is the adjustment step period)

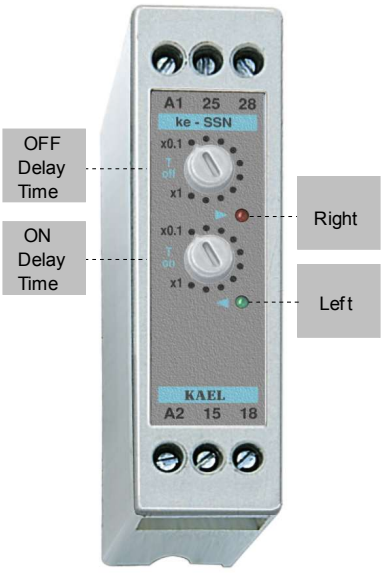
Simple Connection :

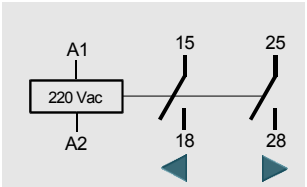


ke – SS

MULTI RANGE, ON and OFF ADJUSTED DIRECTION INVERSE RELAY

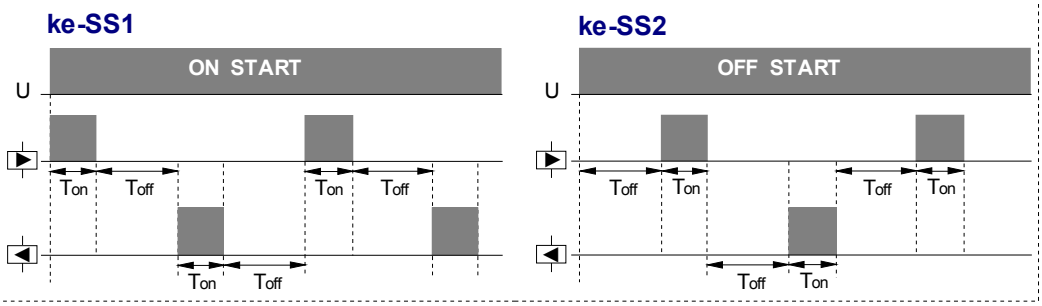
- 8 Items of ON (right-left) time mode and
- 8 Items of OFF time mode selection.

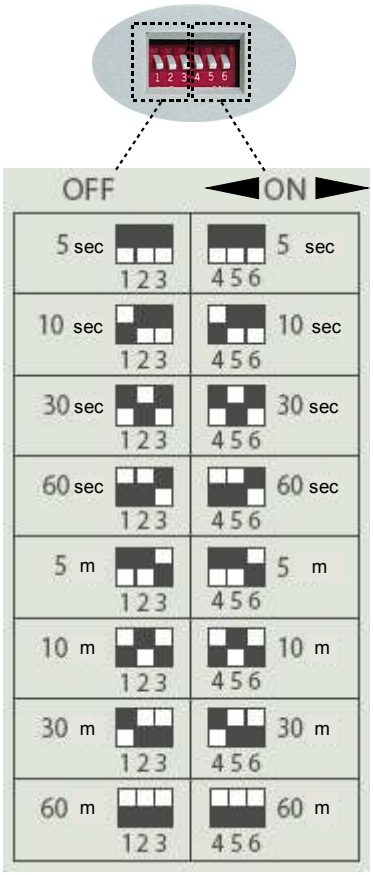




General:

It is microprocessor controlled.8 different RIGHT-LEFT operational time interval and 8 different OFF time interval mode selection can be made by the use of the dip-switch situated near the equipment.The selection of the RIGHT-LEFTand OFF time intervals are handled one by one.





▶ THE TIME INTERVAL SELECTION:

The switches,numbered **1,2,3** of the dip-switch are used at the selection of the OFF time interval, the switches numbered **4,5,6** are used at the selection of the RIGHT-LEFT time interval. Below is the time selection table for RIGHT-LEFT and OFF conditions.

▶ THE TIME ADJUSTMENT SCALER:

The scale of the adjustment potentiometer located on the equipment, is set between 0,01 to 1.When you select your adjustment with the dip-switch,it can be adjusted at the range specified by the interval mode,by the steps of 1%.

Example 1:

OFF
6 sec. – 10 min.

Let's select the OFF (stand by) time interval as above and adjust the value of the T(off) potentiometer to 0,7.

ON
0,6 sec. – 60 sec

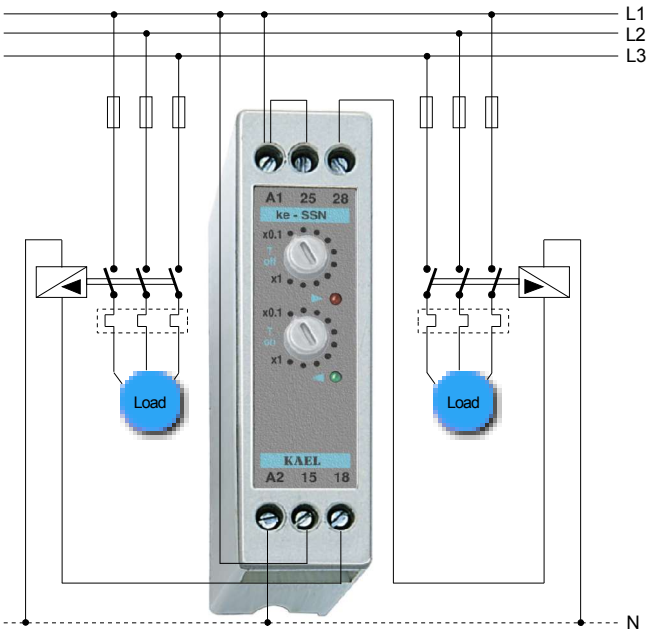
Let's select the ON (operating) time interval as above and adjust the T(on) potentiometer to 0,3.In this case,we can calculate the ON and OFF periods.

T(off) = 0,7 x 10 minutes = 7 minutes (The 10 minutes in the formula is the maximum value of the OFF time selected by the dip-switch)
T(on) = 0,3 x 60 seconds = 18 sec. (The 60 sec. in the formula is the maximum value of the ON time selected by the dip-switch)

You may adjust;the OFF time with 6 second steps (the minimum value specified by the dip-switch indicates the adjustment step value),the ON time though,with 0,6 sec. Steps).

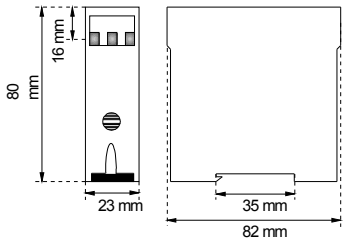
NOTE: During the operation of the relay,you may change the time interval selections and potentiometer adjustment.In this case,it continues to evaluate the new selections.

Simple Connection :



TECHNICAL DATA:

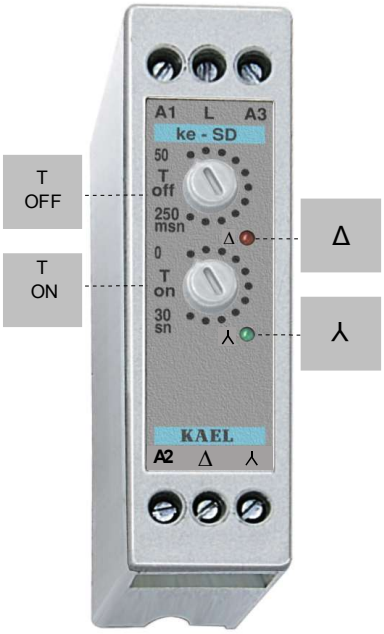
Operational Voltage (Un)	
A1 – A2 terminals	: 220 Vac
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50 Hz
Contact Current	: Max. 3 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm



ke – SD

STAR – DELTA RELAY

- ► T (on) : 0 – 30 sec.
- ► λ ----► Δ Delay time
  T (off) : 50 – 250 ms
- ► 220 Vac or 24 V ac/dc

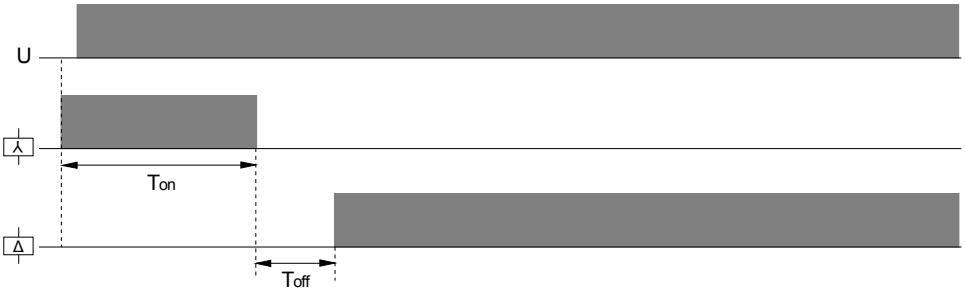


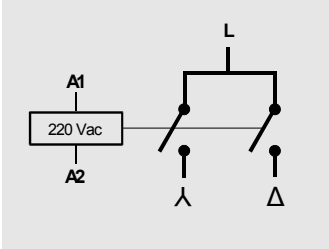
General:

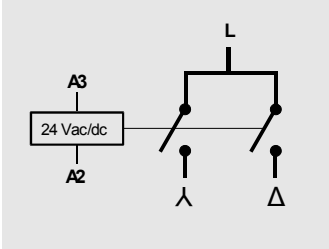
When 220 Vac is applied through "A1 " and " A2 " terminals, star relay is switched on and " λ " terminal becomes a phase output.

At the end of T(on) time,star relay is switched off and phase output from " λ " terminal lasts.
It stops for T(off) pass time.Then delta relay is switched on and " Δ " terminal becomes a phase output.It keeps this position till the energy of the relay is broken.
Because, the switch off time of the contactors depends on their power,brand and age,the pass time from star to delta should be adjusted by the user.

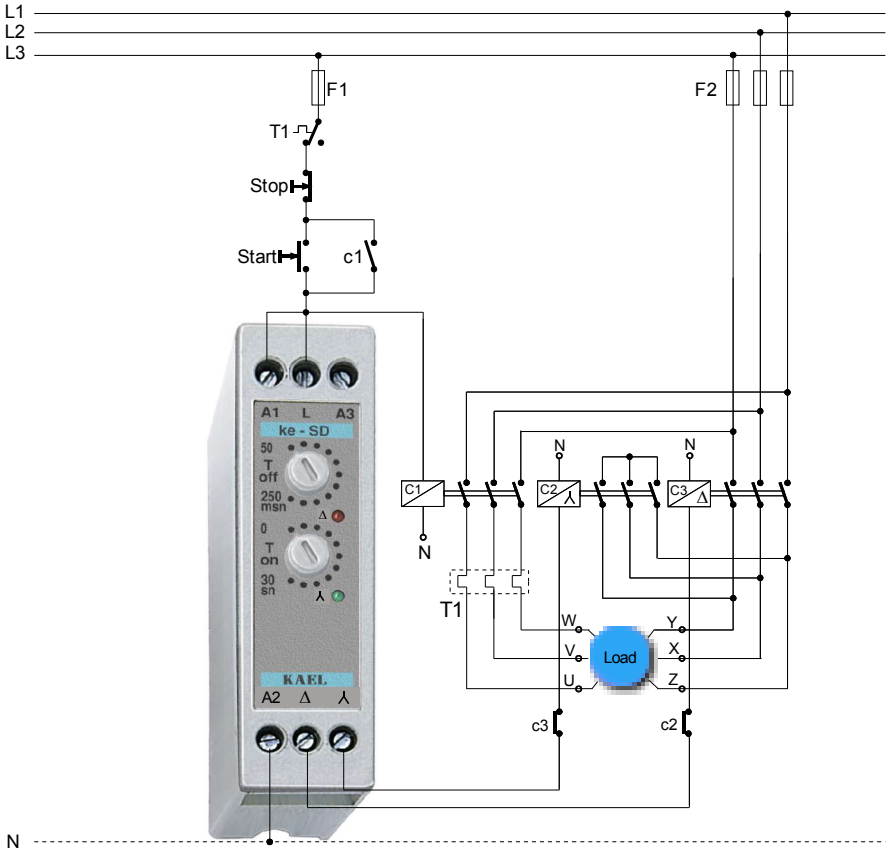
Operation graphic:





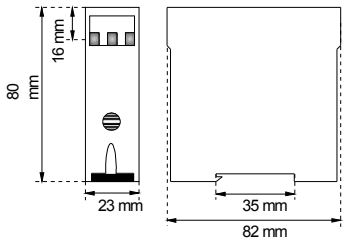


Simple Connection :



TECHNICAL DATA:

Operational Voltage (Un)	
A1 – A2 terminals	: 220 Vac
A3 – A2 terminals	: 24 Vac or 24 Vdc
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50 Hz
Contact Current	: Max. 3 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm



ke – FTR

PHOTOCELL RELAY

► 1 – 10 LUX Adjustment

General :

The relay is used to automatically illuminate streets, avenues, parks and shop windows when the ambient is dark and to switch off the illumination system when the ambient is lit.

► **Operating Principle :**

The photocell sensor (PS), that contains a variable resistor sensitive to strength of illumination, must be place somewhere illuminated by sunlight but not affected from any external or relay's own illumination system.
At sunset time, when the strength of light goes below adjusted lux value, after a certain time delay, relay energizes its contact. Delay time serves to avoid any false decision caused by temporary illumination or headlights.
At dawn time, when the strength of light goes above adjusted lux value, after a certain time delay, relay de-energizes its contact.

■ **ke-FTR**

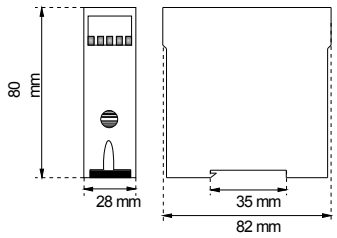
Traditional photocell relay. It has 1-10 lux light strength and 3s-5s turn on-off time delay adjustments.

■ **ke-FTR10M**

It has -10 lux light strength and 25s-40s turn on-off time delay adjustments. Additionally, contains 4A fuse protection in series with contact output stage and manual-auto selection switch.

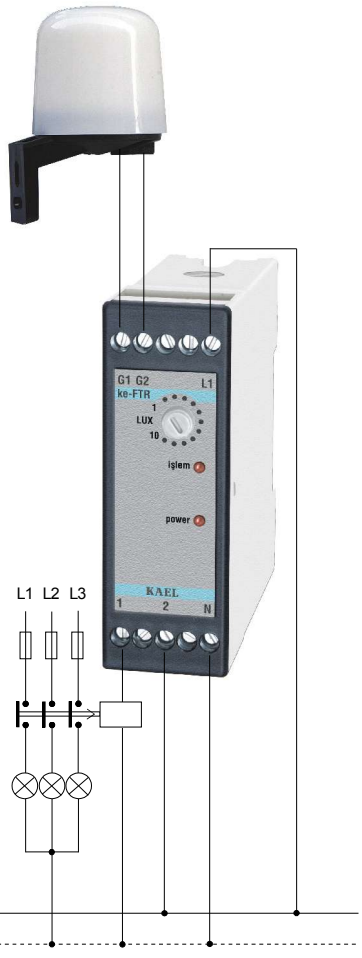
TECHNICAL DATA:

Operational Voltage (Un)	
L1 – N terminals	: 220 Vac
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50 Hz
Contact Current	: Max. 5 A / 240 VAC
G1-G2	: Photocell sensor terminals
Light Strength	:1-10 lux
Hysterisis	: %5-30
Turn On-Off Delay Time	: for FTR : 3s for FTR10M :25-40s
Power Consumption	: < 4 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 28x82x80 mm



ke-FTR10M

Ke-FTR



ke – SKR

LIQUID LEVEL CONTROL RELAY

► 5 – 100 KΩ Sensitivity Adj.

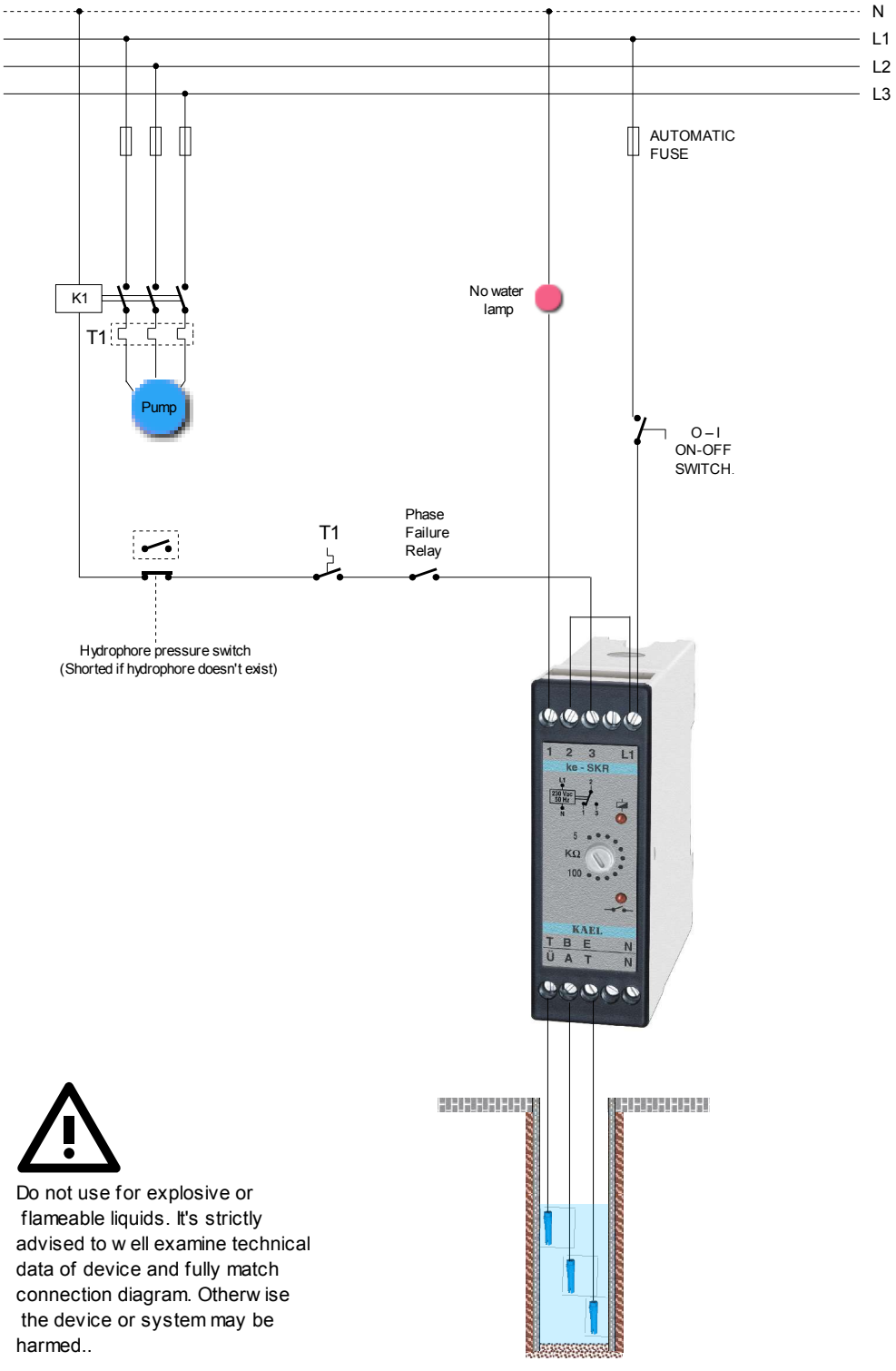
General :

Three electrodes are connected to the “T”,”B” and ”E” terminals.
When the liquid level reaches the upper level electrode (T) then the relay energizes its contacts to turn on the pump.
When the liquid level reaches the buttom level electrode (B) then the relay de-energizes its contact and turns the pump off.
Sensitivity (empedance between electrodes) can be adjusted in the range of 5-100 KΩusing the knob on the front side of the relay.

► **the upper level electrode** : Top (**T**)

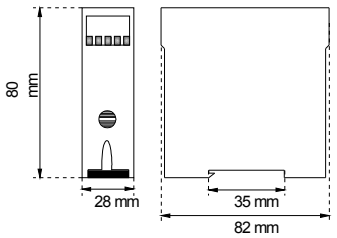
► **the buttom level electrode** : Buttom (**B**)

► **the earth electrode** : Earth (**E**)



TECHNICAL DATA:

Operational Voltage (Un)	
L1 – N terminals	: 220 Vac
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50 Hz
Sensitivity	: 5-100KΩ adjustable
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 4 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 28x82x80 mm

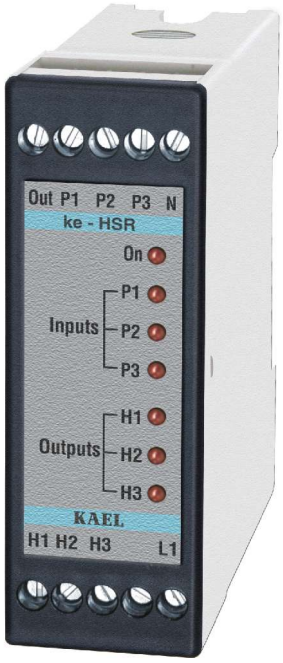


Do not use for explosive or flameable liquids. It's strictly advised to well examine technical data of device and fully match connection diagram. Otherwise the device or system may be harmed..

ke – HSR

HYDROPHORE SEQUENCING RELAY

- ke-HSR2 : 2 Outputs
- ke-HSR3 : 3 Outputs



General:

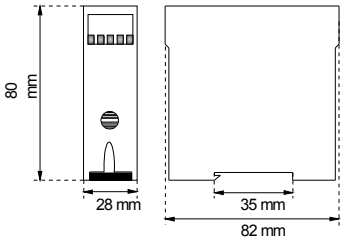
This product is developed for hydrophore pump systems that contain 2 or 3 to make the pumps work in sequence and with equal time periods. HSR2 is designed for systems that contain 2 pumps, HSR3 is designed for 3 pumps.

► Operation Principle

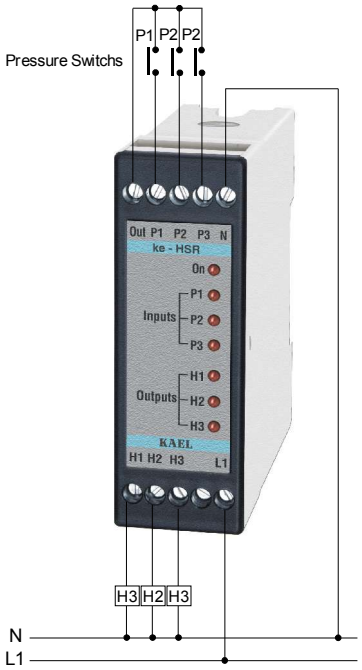
HSR3 :commands the pressure switchs that are connected to the pressure tank (P1,P2,P3). The upper and buttom openning values are as follows.
P1 max. ≥ P2max. ≥ P3max.
P1min. > P2min. > P3min.
Hydrophore sequencing relay HSR, depending on the pressure swtiches that it commands, accepts P1 to be the highest pressure switch, then P2 and then P3 to be the lowest pressure switch and though it takes pumps in sequence when the pressure in the tank decreases startting from the highest to the lowest . When only P1 pressure switch is on, the device turns on the pump output H1 (if already on then it takes the next one) and for the following next 10 minutes (as long as P1 is on it keeps this possition) .After 10 mintues if P1 is still on then the device turns off H1 and turns on H2. Same way after 10 minutes if P1 is still on then the device turns off H2 and turns on H3. This way the deivce sequences the use of the pumps and divide the time between them. The device remembers the sequence and takes always the following pump.
When P1 is off, the hydrophore output which is on goes off too, and next time when P1 goes on the device takes the next output (pump) . For example: if H1 was switched off after P1 switch was off, next time when P1 switch goes on the device takes the nest output H2 on. If P2 switch goes on while P1 is on then the device takes n the next pump that is not already on. The pumps then are shared in time the same way two by two. As long as P1 and P2 are on, the pumps will work as H1-H2, H2-H3, H3-H1 for 10 min for each couple. If P2 goes off, the device turns off the pump is row and works as mentioned above with one pump. While P1 and P2 are on, if P3 goes on too then the device takes the three pumps H1, H2 and H3 until P3 is off. When the pressure switches go off the device turns off the pump that is in the row sharing time between the pumps again as mentioned before.
If P2 goes on before P1 (P1 maybe out of order) then the device will start turning H1 on.

TECHNICAL DATA:

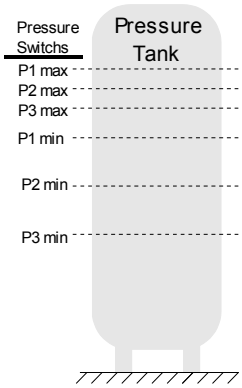
Operational Voltage (Un)	
L1 – N terminals	: 220 Vac
Operating Range	: (0,8 – 1,1)x Un (Un nominal voltage)
Frequency	: 50 Hz.
Pressure switch output	: Out
1.pressure switch input	: P1
2.pressure switch input	: P2
3.pressure switch input	: P3
Pump contact outputs	: H1,H2,H3
Contact Current	: Max.3 Amp/240Vac
Power Consumption	: < 5VA
Device Protection Class	: IP20
Terminal Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 28x82x80 mm



Simple Connection :



It's strictly advised to well examine technical data of device and fully match connection diagram.
Do not apply any energy to the Out, P1, P2, P3 inputs otherwise the device or system may be harmed.



The device's working principle is shown in the diagram below :